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Radio Fun

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SPECIAL ANTENNA ISSUE

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Shuttle to Space Center QSO

During the recent SAREX (Shuttle Amateur Radio Experiment) flight on STS-45, members of the Marshall Space Flight Center Amateur Radio Club (MARC) established contact with the ham astronauts orbiting the earth. Making the initial call from the WA4NZD club station was Dr. Owen Garriott W5LFL who operated the first SAREX mission on STS-9 in November 1983. Thanks to a donated satellite TV system, visitors at the club site (as well as the interlinked school systems) could view the astronauts operating the SAREX equipment via the NASA Select TV downlink. Since the club station could only hold about two dozen people, an ATV (Amateur Television) link was established through the local ATV repeater. This allowed a large number of students, parents and teachers to participate in the event via ATV-equipped classrooms throughout the Huntsville, Alabama, area.

Six students were able to ask questions of the astronauts during the brief window of opportunity. The eight-minute contact passed by in what seemed to be seconds. It was obvious that many students experienced a thrill that will not be soon forgotten.

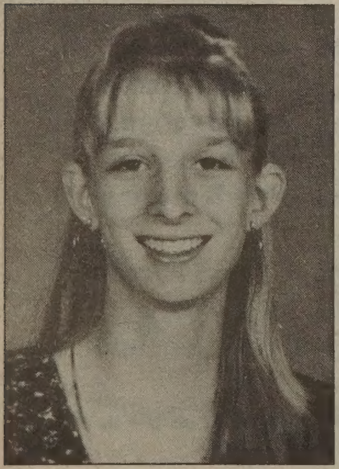
If you scan a listing of Huntsville, Alabama, schools, you will find school names such as Chaffee, Grissom, White, and Challenger. These schools were named to memorialize the men and women who lost their lives while serving in the U.S. space program. Space-related educational activities in Huntsville include the Space and Rocket Center, Space Camp, and the Marshall Space Flight Center's Discovery Lab.

Photo A. Former astronaut Dr. Owen Garriott W5LFL and Huntsville area teachers and students prepare to contact the space shuttle crew (STS-45) from the Marshall Space Flight Center Amateur Radio Club (WA4NZD). Back row (l to r): Dick Christiansen KK4HF, Owen Garriott W5LFL, Don Hediger N4MSN and Doris Sharples KD4FJH. Front row (l to r): Nicole Mims, Afton Stratton and Michelle Hall.

The Sub-Orbital Academic Research Program (SOAR) is another unique program open to area students. The overall goal of SOAR is to solicit and increase youth in engineering and other technical and scientific career fields. The program involves University, High School, Middle School and Elementary School students. Local 5th grade students recently had the opportunity to fly their experiments, one consisting of crickets and the other of meal-worms on board a rocket launched from nearby Redstone Arsenal. The launch was carried live to the classrooms via our local amateur TV repeater. Telemetry data from the flight was transmitted in

Continued on page 27.

Young Ham of the Year



A grateful Angela Fischer KB0HXY was presented with the 1992 Westlink/ Yaesu Young Ham of the Year Award at the 1992 Dayton HamVention.

"This award is not only a reflection of what I have done, but it also represents what the other fellow hams have done for me and for others," Angie said.

"Ham radio needs both youth and maturity," Angie said.

"Without those elmers (helping hams) at one end of the dial and kids at the other end of the dial, this hobby would not be possible. That's because if there were just adults there would be no future for ham radio, and if there were just kids, how would we learn?"

Angie also thanked her parents, Mr. and Mrs. Tony Fischer, her school teachers, her mentor and parish priest, Father Dave Novak N0DN, Westlink and Yaesu USA. Yaesu USA also presented her with a new ham radio station.

She is the sixth youngster and the second St. Louisan to receive the award. Sammy Garrett AA0CR received the award last year.

Angie earned her first amateur radio operator's license when she was just 10 years old.

The annual award is presented to an amateur radio operator who is 18 years old or younger, who best epitomizes the accomplishments of young people in amateur radio. Those accomplishments include high ethical values, community service, promotion of amateur radio and promotion of education through amateur radio.

Angie's enthusiasm for her hobby led her to recruit a number of schoolmates and friends to earn their licenses. Angie is a seventh grade student at Sacred Heart School in Valley Park, Missouri, a St. Louis suburb. She helped establish the Gateway to Amateur Radio Club, geared to help youngsters obtain their licenses. She was elected the first member of the club which now has 14 members from the St. Louis area junior and senior high schools.

"Angie also epitomizes the vast majority of today's youth," Missouri Governor John C. Ashcroft said.

"I am delighted that it's a Missouri youngster who is a national and international example of so much good done by so many youngsters. My compliments also go to Angie's parents, Tony and Laura Fischer," the Governor added.

Angie also received a letter from U.S. House Majority Leader Richard A. Gephart (D-St. Louis): "It is encouraging that young leaders like yourself are forging ahead so boldly. . . . You should be proud for what you have already accomplished and inspired to carry on."

TNX Dennis J. McCarthy AA0A.

Lifesaver of the Year

John B. Young WD0FPY was named the 1992 Lifesaver of the Year by the American Red Cross, St. Louis Bi-State Chapter, during ceremonies held April 14.

Young came to the aid of an unconscious stranger who had collapsed in the Gateway Electronics store on Friday, April 26, 1991. He administered CPR to the customer, Robert Meyer, until paramedics arrived on the scene. The paramedics determined that Meyer had suffered a cardiac arrest. They commended Young for his quick response and proper lifesaving actions. They credited Meyer's successful resuscitation to Young's knowledge and CPR ability.

Ironically, John hadn't planned to be working in Gateway Electronics that day. He had hoped to attend the 1991 Dayton HamVention that weekend but, because of a personnel shortage, he canceled his plans and went to work.

John, 41, has been a ham for 17 years. He is a member of the St. Louis Amateur Radio Club

The lifesaving award is sponsored by the Red Cross, KMOV-TV Channel 4, Schnucks Groceries and the Suburban Journals. The St. Louis Bi-State Chapter of the American Red Cross initiated the program in 1985 to annually recognize unselfish heroes in the St. Louis community.

TNX Dennis J. McCarthy AA0A.

New UK Novice Privileges

Novices in the United Kingdom and the U.S. have an opportunity to communicate on the 15 and 10 meter band. New UK Novices may use CW between 21100-21149 and 28100-29190, and phone between 28300 and 28500 kHz. Callsign prefixes are: England 2E, Scotland 2M, Wales 2W, Isle of Man 2D, Jersey 2G, Guernsey 2U, Northern Ireland 2I; in all cases followed by number 0, 2, 3 or 4 and three letters. In addition, UK Novices also obtain segments of the 160m, 80m and 6m CW/phone band, and 30m CW between 10130-10140 kHz.

TNX W5YI Report, Vol. 14, Issue #7, April 1, 1992.

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Wickedly Simple Antenna Test Fixture

by Larry G. Ledford KA4J

I recently needed to assemble a 10 meter Ringo-type antenna and tune it to resonance. The prospect of standing on a roof heated by the August sun didn't appeal to me so I came up with a fixture that would allow me to temporarily erect an antenna in the yard for initial assembly and testing. It consists of simply a two-foot length of pipe set in a concrete-lined hole in the ground.

See Figure 1. This forms a socket that will mate with any convenient length of standard sized TV mast (or 1" i.d. pipe), allowing you to work comfortably and safely on either a vertical type antenna or a yagi. This does away with the need for using sawhorses or other jigs that require storage space.

The pipe is set in concrete to avoid problems that could arise from driving it directly into the ground: distortion of the pipe from hitting it with a sledge hammer, clogging the pipe with dirt, having the pipe enter the ground at an angle, and hitting a rock or old concrete.

You will need a two-foot length piece of 1-1/4 " i.d. galvanized steel pipe that is threaded on one end. (You can't use PVC here—save it for up-in-the-air antenna projects!) I was unable to buy a two-foot length because the stores only had it in three-footers. If you live in the North where there is a frostline below the surface of the soil, you may wish to use the full three feet and more concrete. If not, cut off the extra foot. Get a mating floor flange and two 1/4-inch bolts and nuts. You will also need a scrap piece of steel or aluminum to cover the bottom of the flange so the concrete doesn't ooze into the pipe. I used a quarter-inch scrap that even had the holes drilled in the right place. The hole will require slightly more than an 80-pound bag of cement mix, so find some small rocks, brickbats or some scrap iron to help fill the hole.

For vertical alignment you will need to use (temporarily) two small levels, a 10-foot length of TV mast, three lengths of rope and three or four hose clamps.

Choosing the Location

Your first consideration in site selection must be safety! Ask yourself this: If I place the fixture in this location, could any antenna I erect fall or come into contact with power lines of any voltage? If the answer is yes, then move the antenna to some other location!

Are there any trees or large metallic objects that will affect the tuning of the antenna nearby? You need an area with some privacy so you can work at your best and leave it without fear of tampering. It should not be very near to your property line if you wish to stay on good terms with your neighbors. You should have good access to and from the area. If you assemble and test a big antenna and then have to disassemble it to get it out, you have defeated your purpose. (Remember the boat-in-the-basement rule: Don't build an antenna any bigger than can go out the largest door!) You need AC power available from at least your extension cord, and, if possible, some shade and a lawn chair for comfort.

Construction

After you have selected a site, screw the two-foot section of pipe into the floor flange and, using the two quarter-inch bolts, secure the flat piece of steel on the bottom of the flange. It need be only finger-tight as the concrete will soon render it immovable. Now, using a set of post-hole diggers, dig the hole, stopping to see if you have it the correct depth (using the pipe as a gauge). The correct depth is when the top of the pipe is flush with the surrounding ground. This will allow you to mow over it with the lawnmower without fear of the blade hitting the pipe or concrete. If you have an area with a lot of water flow, you may wish to let the pipe stick up perhaps half an inch, and "mound" the concrete to aid in runoff. This would still leave clearance for the mower.

The hole only needs to be the diameter that the post-hole diggers will cut (about 8 to 10 inches). However, when you get the correct depth, use the diggers to cut out the sides of the hole near the bottom. It should resemble an inverted mushroom with only a small cap.

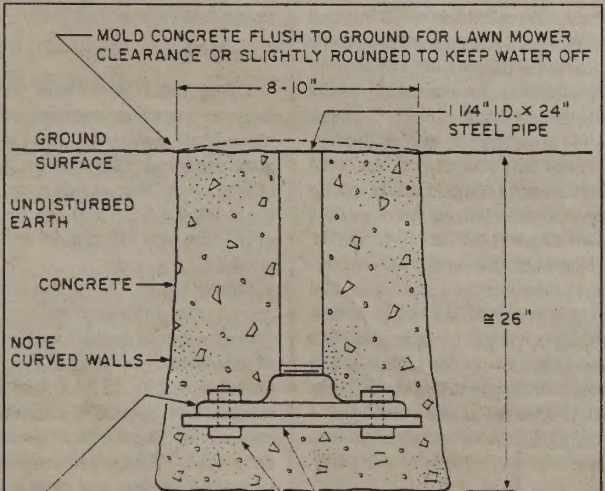
MOLD CONCRETE FLUSH TO GROUND FOR LAWN MOWER CLEARANCE OR SLIGHTLY ROUNDED TO KEEP WATER OFF
8 - 10"
1 1/4" I.D. × 24" STEEL PIPE
GROUND SURFACE
UNDISTURBED EARTH
CONCRETE
≅ 26"
NOTE CURVED WALLS
FLOOR FLANGE FOR 1 1/4" PIPE
SCRAP STEEL OR ALUMINUM TO COVER FLANGE OPENING
1/4" × 1" BOLTS & HARDWARE 2 REQ'D.

Figure 1. Cross section of the underground antenna mount.

For alignment we will use a trick of the trade that TVRO installers used to set polar mounts for dish antennas: Insert a 10-foot section of TV mast into the section of pipe in the hole and guy it with three lengths of rope. For ease of adjustment, use taut line hitches at the mast end. If you don't know this knot, look in any *Boy Scout Handbook.*

At near eye level, mount two levels 90 degrees apart around the mast using hose clamps. Adjust the tension on the ropes until the bubbles on both levels are centered. There is some play due to a slight difference in pipe and mast diameters, but it is not significant. The mast should be vertical.

Now pour your concrete and tamp it gently to pack the mixture. Again check your levels to see that it is still vertical. You can force the pipe to move to the correct position now without much trouble. Wait an hour and trowel the top of the concrete for a smooth finish.

You can remove the ropes and mast the next day, but you should allow a couple of days for the concrete to cure, for additional strength, before using it. Modern concrete will continue to harden and strengthen for about a month.

When not in use, put in a plug to keep out rain water. See Figure 2. This plug consists of a two-foot length of 1" diameter wooden dowel rod or broom handle with a cover made from a 2" x 2" (or larger) rubber pad nailed to it. Don't make the wooden rod anywhere near a tight fit because the pipe will draw moisture and if the wood swells, it might be hard to remove. We only want to keep the pipe from filling with water because a hard freeze would rupture it and severely weaken it or, even worse, distort the shape so that a mast would not fit.

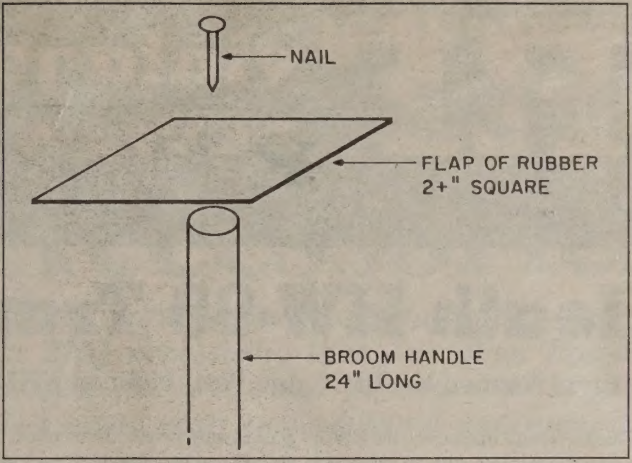

Figure 2. The plug.

There is one type of antenna that you may encounter that will not fit the fixture: AEA Isopoles and other vertical collinear antennas that have the coax exit through the bottom of the mast. However, with the use of an adapter, Isopoles and others of this type can be mounted and used in the fixture. This adapter is made from three lengths of pipe welded together. See Figures 3 and 4 for details. The 50-inch length of 1" i.d. pipe fits down into the fixture. The other two 24" lengths of pipe in sizes 1-1/4" and 1-1/2" i.d. are used to hold the mast of the antenna while it's being tested. This will allow you to test antennas mounted on either 1" or 1-1/4" i.d. masts (separately). Two hose clamps are used to hold the three sections of pipe in the correct position until welded. To hold the mast at a fixed position and still allow the coax to exit, a U-bolt and clamp is bolted around the 1" i.d. pipe with the ends of the U-bolt under the 1-1/4" and 1-1/2" pipes.

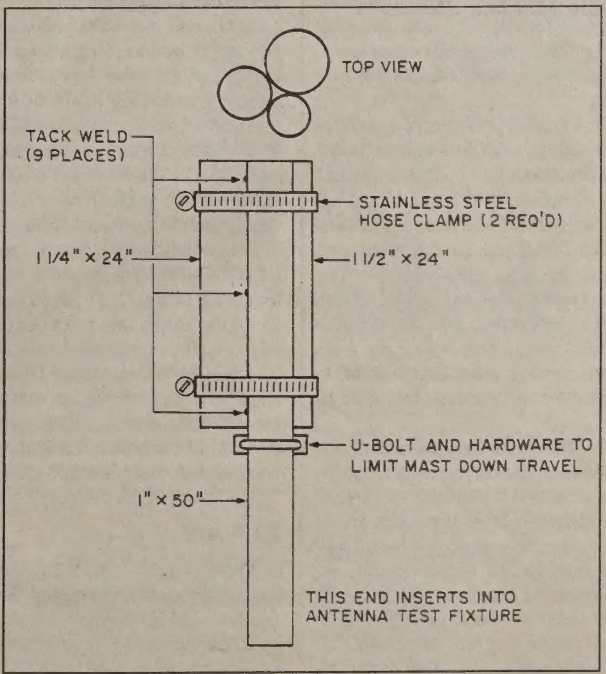
TOP VIEW
TACK WELD (9 PLACES)
STAINLESS STEEL HOSE CLAMP (2 REQ'D)
1 1/4" × 24"
1 1/2" × 24"
U-BOLT AND HARDWARE TO LIMIT MAST DOWN TRAVEL
1" × 50"
THIS END INSERTS INTO ANTENNA TEST FIXTURE

Figure 3. An adapter to mount antennas with through-the-mast coaxial feed into the antenna test fixture.

The type of pipe used to make the adapter is important. Since you are having it tack welded, you shouldn't use galvanized pipe because it releases toxic fumes when heated to welding temperatures. So try to get "black" pipe. The fellow who welded mine (which had one section of galvanized pipe, and he welded it outdoors) advised me to either switch to black pipe in the future or find another welder. I want to keep him safe and happy as he does not charge anything!

Using the Test Fixture

Using the test fixture is very simple. Mount the antenna you wish to assemble on a length of standard TV mast that is comfortable to work on while standing on the ground. This length should be at least a quarter wavelength to get a consistent impedance. For 10 meters, this is just a little over eight feet. The stock lengths of TV mast are five and 10 feet, so for 10 meters a 10-foot length is about right (remember that we will lose two feet of the mast that goes down into the ground). For 6 meters and above, an eight-foot length is a good compromise. When the antenna is completed, connect it to an SWR bridge and signal source (I am using a pair of the MFJ SWR analyzers that makes this a breeze!) via a length of coax and stand back and check the SWR.

Remember to stand back at least a quarter wavelength from the antenna while making your readings. It is interesting to move close to the antenna and watch the SWR change! After a reading is made, power down and make your adjustments to the antenna. Repeat this until the SWR is at an acceptable level. It is now a very simple task to remove the antenna and mast from the fixture so that your test rig simply disappears!

When working with yagis or verticals with radials, avoid using a length of mast that would leave any protruding elements or radials mounted at eye level. If you must leave an antenna where such parts might be a hazard, flag the dangerous parts with a length of brightly colored plastic tape to warn visitors or interlopers to be careful. This tape is often sold at hamfests or can be begged from your local utility company crew.

If you've followed me this far and have built this fixture, congratulations, you are on your way to mastering the antenna game. You now have a basic piece of infrastructure, and you have a leg up on your brother hams who are not as well prepared to assemble and test antennas that they buy or build. You, on the other hand, can now build and test a new antenna very rapidly and, with the adapter, test the weird or commercial antennas that you pick up at hamfests.

If you were to build two of these and mount a remotely readable FSM (field-strength meter), it would be a good start on an antenna gain measuring system. The repeatability of the setup would be very good, which could make it easier to carry on a long series of tests on an antenna that would need many changes in its design and development. RF

RF vintage review

Heath HW-99 Transceiver

by Errol Naimon KA9HCC and Patty Naimon KN2F

Heath's Novice transceiver, the HW-99, comes complete with an integral power supply and a solid 50 watts on 10, 15, 40, and 80 meters. The rig is solid-state and ruggedly designed, and should see years of trouble-free service. The minimal controls will simplify life for the Novice, but will utterly frustrate just about anyone else.

The front-panel controls consist of a power on/off rocker switch, a four-position rotary band switch, a large tuning dial, a volume adjust for output to speaker/phones, and a level adjust which varies the drive to the transmit amplifier chain. The level control is functional only up to the nominal 50 watt output limit, provided that output VSWR is low; otherwise, an automatic-level-control (ALC) circuit derived from a directional coupler at the output of the transmitter overrides the front-panel level control and cuts back the transmit drive.

A 10-segment LED bar graph is used to display receive signal strength relative to a no-antenna (all segments off) condition. In the receive mode, the display source is the AGC detector tapped off the IF amp. In transmit, the display is driven by a relative power amp which obtains a voltage from the ALC pick-up, the directional coupler. No tuning controls are provided since the PA is a broadbanded linear and no tuning is necessary.

The forward and reflected components are summed at the output of the coupler. If either forward or reflected power (or both) increases, so does the display indication; hence, a greater number of lights on the display does not necessarily mean more power out. Operating into a high VSWR load can easily light up the whole bar graph, giving the illusion of higher power output even though little or none is actually getting out.

The transceiver is executed on three single-sided boards: an oscillator board, a transmit/receive (T-R) board, and a power-amplifier (PA) board. Single-sided boards for RF kits have characteristics worthy of note for the uninitiated. On the plus side, they are less costly. The components are usually more spread out (i.e., less dense) than double-sided or multilayered boards to make room for more routes, since almost all of the tracks must be crammed into a single layer.

This allows for simple troubleshooting. Most of the components are easily accessible, and the chances of shorting something while poking about are reduced since those pesky traces and pads are hidden on the less-accessible underside of the board.

On the other hand, since the traces are all on one side, they necessarily are arranged more densely even though the components are more spread out. Inevitably this means that many traces and pads at substantially different DC levels will end up adjacent to each other, increasing the probability of a catastrophic solder bridge during construction. Equally detrimental is the loss of a ground plane which would improve amplifier stability and harmonic suppression by providing an ultra-low impedance/inductance return for supply current as well as an effective shield.

Building the Kit

Construction of the kit is straightforward although not necessarily simple. Take the time to familiarize yourself with the instructions. No fewer than 10 (count 'em . . . 10!) double-sided pages of instruction-manual changes are included. To avert disaster, read over the changes carefully and enter them all in the manual. Don't delude yourself into thinking that just by having the errata handy you will catch all of the goofs . . . you won't! And do this *before* beginning construction, not as you go along.

The time estimate for completion of the kit as given by Heath is 16 hours. It took me about twice that to complete the job, and a good deal more time to track down the ouches.

Oscillator Board

This is the largest board and the simplest to construct. I recommend that L218 be installed before capacitors C269 and C271-C274 to make it easier to push L218 lugs into the board.

T-R Board

This is somewhat smaller than the oscillator board, but it is more densely arranged and contains a number of hand-wound transformers and inductors which no doubt will prove challenging to the Novice kit builder. Carefully note the position of the color dots and notches on rotary switch SW101 in the instruction manual *changes* or you will be lost in space later. Expect a battle from D123 and D124 as the leads are just barely small enough to be inserted into their designated circuit-board holes.

Before building this board, check for a foil-to-foil short to ground at the junction of C134 and C137 (about the middle of the board). My board *was* shorted there after construction. I thought it was a solder bridge, but after removing all of the components in that section and meticulously cleaning all the solder off that part of the board, it still showed a dead short. A trusty X-acto® knife made "short" work of the problem.

PA Board

The power amp board is the smallest but not the least challenging. Several hand-wound transformers make construction interesting. A special word of caution concerning the broadband output transformer T304: Bare wires are soldered to printed-circuit-board (PCB) pieces to serve as leads to connect the transformer to the PA board. Make sure that no part of these wires protrudes over the top of transformer PCB ends, since there is almost no clearance between the transformer and the PA shield. A sharp edge of a wire will easily penetrate the paper insulator on the PA shield and potentially short the 30V supply to ground. You may wish to check up on that situation with an ohmmeter following installation of the PA board.

The Chassis

The AC wiring, 12V supply, controls, and input/output jacks are all chassis-mounted. Exclusive of the 12V regulator (U1), the entire 12V supply is mounted on a 7-lug terminal strip. With board-to-board interconnects here as well, this lug strip gets to be pretty busy and, if difficulty arises, it is not easy to repair. Circuit-board mounting of this section would simplify life greatly.

A word of caution: Configured as it is, U1 is not blow-out proof. Output capacitor C12 (100 µF) has ample energy storage to destroy U1 should the *input* to U1 become shorted to ground. The schematic is somewhat deceptive at the 12V supply. Circuit board ground and chassis ground are shown as isolated. In fact, they are made common in at least two places here: first at the center tap of T1's secondary (the red/yellow wire) and the tab of three-terminal regulator U1.

The board-to-board interconnects are Molex® terminals and are time-consuming to crimp without the proper tool.

Finally, the headphone jack is a mono jack. If you have stereo phones (who doesn't?) and don't fancy listening with just one ear, you either will need a mono/stereo adapter or you will need to replace J1 with a stereo phone jack and tie P206-1 (center conductor) to both left and right channel phone lugs.

Alignment

Following repair of all the boo-boos, alignment was a snap. Goofs: two diodes incorrectly inserted; three board shorts (two ours, one theirs); SW101 installed correctly, but shaft notch 180 degrees reversed (see previous comments concerning instruction manual changes); bad C246; L210 up in a glorious puff of smoke; and J1 soldered incorrectly (don't rely on the pictorial, 4-8, as it does not clearly show the lug hook-ups; you must rely on the schematic).

However, the manual calls for equipment that the average Novice probably doesn't have: a 10 MHz frequency counter and an RF wattmeter capable of measuring 75 watts. Finding C246 bad would have been difficult without a scope, since RF voltages at the HFO are pretty low and would scarcely show up on the built-in RF detector. A 50 MHz scope came in handy here showing a beautiful low-level sine wave (on all bands) at the HFO side of C246, but only DC present at the HFO buffer side.

It may be of interest to note that resistance readings given in the manual were obtained using a Heath IM-5218 VTVM. The manual notes that readings taken with other ohmmeters (because of different measuring voltages and currents) may be considerably different. We found this to be true.

Don't rely on Heathkit. I promptly ordered (paid up front) a list of all necessary replacement parts as none were in stock. I was told that a two-week lead time was typical. I then ordered the same (equivalent) replacemnt parts from the will-call desk of a local electronics wholesaler and subsequently picked up the parts three days later. It has been two months, and I haven't heard from Heathkit yet.

One disquieting feature I noted during alignment of the VFO and in subsequent operation thereafter was the lack of a positive end stop on the tuning vernier. The mechanical end stop is supposed to be created by the end of a semicircular groove on the tuning dial within which ride two screw heads contained in the vernier assembly. It is difficult to tighten the vernier assembly sufficiently on the tuning dial to prevent the dial from slipping as pressure is exerted against the stop. This knocks the VFO out of calibration and puts you off frequency. Because you are on the easy end of a gear reduction, you may not even notice that an end stop has been encountered, and you will be merrily knocking your rig out of calibration repeatedly.

Operation

For a Novice sitting down to use a transceiver for the first time, the HW-99 would be one of the last intimidating radios to operate. With such a simple and uncomplicated front panel, there isn't much to adjust or misadjust. Heathkit understood the obvious inexperience and jitters that go along with those early QSOs. This basic rig will help Novices gain confidence as they enjoy those first contacts.

However, as the new ham gains experience, the realization will come that there are some features that Heath could have included that wouldn't have complicated the front panel too much. We've already discussed how easy it is to change the VFO alignment by dialing the tuning vernier past the end stop. A crystal calibrator would come in handy to help the operator maintain correct alignment or at least know how far off the dial is. It's always better to be sure of your frequency rather than to guess if your dial reading is accurate. As you gain new operating privileges by upgrading to a General class license or higher, it will become more apparent that the dial may be 10-15 kHz off at one band edge—and the FCC frowns upon people who operate where they don't have privileges.

Another complaint is the lack of a meaningful meter. The 10-segment LED bar graph looks impressive (all these tiny red lights), but can be giving you misleading information. The manual cautions you to never turn the level control past a point where more than eight segments are lit. It explains that if you do, RF power output will not increase because the ALC circuit will automatically reduce the carrier level from the transmitter.

We checked this with a Bird 4410A wattmeter. The ALC worked as it should, but not at the indicated number of LED segments lit. For example on 80 meters with seven segments lit, we measured 42 watts output. We increased to 10 segments lit and obtained a peak power output reading of 58 watts. As we continued to turn the level control, 10 segments remained lit. On 10m, four segments lit was the maximum that would light and was the maximum power output. The maximum forward power we measured on each band was: 10m, 42W; 15m, 71W; 40m, 62W; and 80m, 58W. We also found the level control to be very touchy. It didn't take much of a turn to dramatically increase/decrease power output.

The tuning dial is marked in 5 kHz increments and numbers indicating frequencies are every 50 kHz. Markings every 1 kHz and numbers every 10 kHz would have been nice.

One problem that I've encountered has to do with the volume control. For most QSOs, it's fine. But when you're listening to a strong signal, it doesn't turn down far enough. More than once, I've been blasted out of my headphones because of this. (Or, if you're using the speaker, the sleeping kids could get blasted out of their beds.)

Being a radio designed for the Novice, it doesn't have 20m, nor does it have the WARC bands. Adding the capability of having those bands would have necessitated extra circuitray (obviously) and may have meant using double-sided circuit boards. Since the object of this radio was to give the Novice a good start in amateur radio, to keep the kit building as easy as it could be, and to keep the price down, it probably isn't reasonable to expect it to include the other amateur HF bands. Nor is it reasonable to expect lots of other features that are found on more expensive HF rigs. This is a good, basic HF transceiver.

Conclusion

Using the HW-99 was fun. The receiver was clean sounding and sensitive. Most of the comments I received about the transmitter were good. Some of them were "Rig sounds great," "Doing a good job," "You can be proud of it," "Sounds FB to me," and "Very good."

On the whole, the rig is a well-conceived, straightforward piece of work. An experienced builder will not be at all intimidated by it. The first-time builder probably will be. In uses, with a good antenna, the rig performs admirably with minimal fiddling, no doubt much as the designers at Heathkit had imagined. The lack of adjustment and meaningful information about power output or state of tune given by the rig are its biggest flaws. **RF**

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letters

Write to: Radio Fun, 70 Route 202-N, Peterborough, NH 03458

Robert Golaszewski N8NOO, Okemos MI In reference to the proposal to modify the Novice licensing system by eliminating the option of having the test administered by two volunteer examiners of General class or higher license, I submit that this is a bad idea that should be opposed. The ARRL and W5YI-VEC have petitioned the FCC to require a Novice license candidate to test under the three-examiner VEC system. The only cogent arguments that the ARRL makes for this change (in *QST*, April 1992) is that it will ease the burden on the FCC by having the VECs weed out the defective Form 610s before they get to the agency, and that the integrity of the Novice examination system will be enhanced.

As to the problem of inaccurate Form 610s, the Novice license has been administered by helpful elmers for about four decades, with little proof that the FCC has been unduly burdened by an overwhelming number of improperly filled out applications. As for the concern that there is a problem with fraudulently certified Novice tests, I find it highly improbable that this occurs with great frequency. The Novice exam is so easy that few individuals would need to have to resort to cheating in order to pass it. While the evidence for fraudulent Novice exams is lacking, I call attention to the item in the same issue where the FCC documented that VEC examiners in California were taking bribes to falsely certify Extra class licenses. My hunch is that the two-examiner Novice testing program is at least as honest as the VEC system. Also, let's get real for a minute: Hams would have difficulty getting people to become Novices if they could legally pass out licenses on the street corner. Any ham who hopes to fatten his wallet by accepting bribes to falsely certify Novice applications is living in a fantasy world.

My main objection to this proposal is that the VEC examination system is in many cases not as convenient as the ARRL and W5YI-VEC suggest. For those in urban areas, finding a convenient test site is little problem, but the same is not true in outlying rural areas. According to a printout I obtained from the ARRL, listing test sites in my state (Michigan), there is only a single test site in the upper peninsula (located in the far northwestern corner), and only two in the northern half of the lower peninsula. Travel distance to the nearest sites in these areas of Michigan can be as great as 125 miles, with a 75-mile distance being typical. Many youngsters hoping to start out in ham radio would find it prohibitively difficult to arrange travel for an amateur radio exam. The two-examiner system is far more convenient: Finding two General class or higher amateurs to administer the Novice test could be as easy as contacting a local ham club, or contacting the ARRL for a list of nearby amateurs willing to administer a Novice test. Also, elmering a youngster is easier if you tell them that you can administer the test to them yourself (along with the help of another General class or higher operator).

I would like to make a proposal to extend the two-volunteer examination option to the Technician class license. Since new Techs are being licensed at a rate five times greater than Novices, the codeless Technician's license is now by far the preferred method of entering amateur radio. Elmers should find administering the codeless Tech license no more difficult than the Novice exam (in fact, since many General class and up stations are without a code key, there is often a problem with generating a 5 wpm code test that conforms to FCC rules). To anyone who feels that my proposition would result in widespread exam fraud: Given the fact that the exact text to all the questions and answers is available at every Radio Shack, how many people would need to cheat?

I find it puzzling that the ARRL continues to find ways to put up roadblocks that make becoming a new ham more difficult, particularly since they would likely be a major beneficiary of growth in the ranks of amateur radio. I encourage other hams to write to the FCC and oppose this proposal.

Tom Molnar, Carson City NV You'll notice that I don't have a callsign to put after my name. That's because I haven't gotten my license yet. I got all-fired-up interested in getting the new no-code Tech license sometime last year, but ended up losing interest after running into much negative talk from "old-timers" (a term that would probably be better replaced with "pre-existing license holders who think code is the price of admission and if you don't learn the code, you're worthless"). Actually, until recently, I'd never met any hams in person. All the dealings I've had with them was via BBS (landline type). I get the feeling that some "existing license holders" remember little from the information that they needed to know to obtain their licenses. I was chatting (via BBS messages) with another fellow who was also just starting to study for his license. We talked about our interest in 2 meter FM, and how we later intended to go for the code test to upgrade our no-code Tech licenses. Well, along comes some old pro who informed us that we couldn't use the 2 meter bands as no-code Techs. We informed him that according to everything we'd read, we could indeed access this band. Well, after several messages worth of arguing, he decided that we could, and it was his decision that he was going up to 10 meters to "get away from us." After all, everyone knows what kind of people get a "no-code" license.

It's really tough for me to find the time to study because I'm a line haul driver for Consolidated Freightways, and I'm gone from home *a lot*. Pretty soon, my interest waned and I just put my books away.

Continued on page 23

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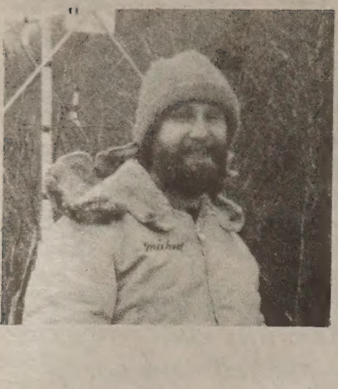

the tech side

by Michael Jay Geier K1BUM

Microphones

From what I hear on the air, the second most popular technical topic just might be microphones. (The number one topic is antennas.) There are several different kinds of microphones, each with unique characteristics. Let's take a look at the various kinds of mikes and at how you connect them.

In The Beginning . . .

The very first type of microphone was the carbon mike, invented by Alexander Graham Bell, obviously for use in the telephone. (Ten meters was not real busy in those days!) This simple mike had loosely packed carbon granules and two electrodes (connection points). One of carbon's characteristics is that it conducts electricity, but not tremendously well. In other words, it has resistance. In fact, many resistors are made out of it. By using a diaphragm to capture the sound waves and vibrate the carbon pack, Bell was able to modulate, or change, a DC voltage in step with the sound waves. It worked, but not too well, because the amount of change was not very great. After some mechanical refinement, it worked well enough that the carbon mike was the standard telephone microphone until just a few years ago! Due to the random nature of the carbon pack, though, the modulation was not very precise. That is, it had significant distortion. Also, the carbon tended to stick together in humid weather, requiring the user to bang on the mike now and then in order to loosen it up. I remember doing that to my telephones whenever the transmitted sound got weak and distorted. Except in older telephones, carbon mikes are not used today, because there are far better microphones available at low cost.

Crystal Power

No, not the New Age kind. Not the frequency-determining kind, either. Well, actually, the crystals used in crystal mikes are pretty similar to both of those things. Some materials, such as quartz and some other stones and ceramics, have an unusual property known as piezoelectric (pea-ay-zo) response. That is, if you apply voltage across them, they flex. Also, if you flex them, they generate voltage! A diaphragm attached to a small piece of piezoelectric material makes a decent microphone, and such units were once very popular. These mikes produce rather high output voltages (compared to other mikes) and also have very high impedance. Those characteristics were quite compatible with tube gear, but are the opposite of what is desired with solid-state circuits. Nonetheless, there are some ceramic mikes still being sold, primarily because they have a "punchy" sound which some operators prefer for HF DX (lowband long-distance) communications.

To connect a ceramic mike to a modern transceiver, it is best to use a matching transmformer to change the mike's high impedance to the low value required by the rig. Another way to look at it is that you are changing the high voltage, low current signal into a low voltage, high current one, in exactly the same way a step-down power supply transformer does it. High-impedance mikes tend to be susceptible to RF feedback from the transmitter, at least on HF. If you want to use one of these mikes, I recommend careful shielding of both the mike and the matching transformer.

What A Dynamo

Until very recently, the most popular type of microphone was the dynamic mike, so called because it uses the principle of the magnetic dynamo to produce its output. This design is essentially the same as a speaker. It has a magnet and a coil, with a diaphragm suspending the coil near the magnet. Vibrations in the diaphragm cause the coil to move relative to the magnet, with the result being that a small voltage corresponding to the sound wave is generated as the coil cuts through the magnet's field. With a thin, flexible diaphragm, this arrangement works very well. Dynamic mikes are nearly indestructible, and can be designed to provide music-studio-quality sound. They have low impedance, which makes it easy to connect them to today's radios.

Because dynamic mikes use coils, they tend to pick up low-frequency magnetic fields. If you've ever tried to use one near a TV set or a computer monitor, you've experienced the problem. Careful shielding can help sometimes, but you may find instances when you must move the mike away from the interference source in order to quiet the noise.

A Number One Hit

Far and away, the most popular mikes in use today are of the electret condenser variety. They work as well or better than dynamics, and they're much smaller. You'll find them in everything from walkies to base station desk microphones. Although they are tiny and cheap, electrets actually are quite complex.

The term "electret" refers to the diaphragm itself, which is permanently charged with a static voltage. Suspended between two electrodes, it looks like a capacitor. (Hence the term "condenser," an old term for "capacitor.") The permanent electric charge works like the electric equivalent of a magnet, forming an electrostatic dynamo; mechanical movements cause small, corresponding electric charges to appear at the electrodes. This small signal is amplified by a tiny FET (field-effect transistor) preamplifier mounted right inside the mike! These mikes require a source of DC power to operate the preamp and can be confusing to work with. Let's take a look at how you wire one up.

The DC can be supplied by a battery or a power supply. Because these mikes use very little power, a battery is a good choice, since it eliminates any possibility of hum problems. Typically, one AA cell will run a condenser mike for about a year of continuous use. Not bad, huh?

There are two kinds of condenser mikes in common use. One has three wires and the other has two. The three-wire type uses a separate wire for its DC power input, while the two-wire variety carries the DC on the same wire as its audio output.

To connect a three-wire mike, run the DC to its positive (+) input. Connect its ground to circuit ground. Now, connect a capacitor in series with the mike's audio output. A 1 µf electrolytic should work fine. Be sure to connect the capacitor with its positive (+) terminal hooked to the mike and its minus (-) terminal connected to the radio. That's it! The mike should work fine. If there isn't enough output, try using a higher DC voltage. Most mikes are designed to work up to at least 6 volts, and some go as high as 10.

To use a two-wire mike, you need a resistor along with that capacitor. Anything from about 2k to 10k should work fine. Connect one end of the resistor to your DC supply's positive line and the other to the mike's audio output line. Now, connect the positive end of the capacitor to the mike's audio output line also. Connect the mike's ground to circuit ground and you're all done.

Many radios are designed for two-wire mikes and provide DC right on the mike connector. In fact, some even have the resistor already in series with the DC, requiring only that you connect it to the audio output of the mike and then connect the capacitor in series with the rig's audio input. If you're not sure, take a look at the rig's manual, because you will fry the mike if you connect it up to DC with no resistor.

If, in the interest of size, you want to use a smaller-value capacitor, you can. If your cap is too small, though, the low-frequency (bass) response of the mike will drop off. Actually, you might want to do that on purpose, especially with an HF rig, in order to get that punchy sound that helps you cut through interference. Compared to dynamic and ceramic mikes, condenser mikes sound "bassy," which is very nice for VHF FM, but less desirable on the low bands. To get the punchy effect, try using a 0.1 µf capacitor.

Condenser mikes have low impedance, so they work well with modern gear, without the use of matching transformers. But *never* omit the capacitor or you will apply DC to the rig's input circuits and this could damage them. Of course, if the radio already has its own capacitor, then you don't need another one.

If you experience RF feedback, you may need to bypass the leads with capacitors. On a three-wire mike, connect a 0.1 µf capacitor between the positive DC line and ground, and a 0.01 µf cap from the audio output to ground. On a two-wire mike, try a 0.01 µf to 0.1 µf cap from the audio output to ground. Also, put a 0.1 µf cap from the DC line to ground on the side of the resistor which is *not* connected to the mike. In any event, be sure to mount the capacitors at the mike, not down at the plug where it connects to the radio.

Condenser mikes have a small hole in their cabinets where the sound enters. If you speak directly into the hole, you may cause "popping" noises on certain speech sounds like "P" and "B." Try putting a piece of foam around the mike or turning the mike sideways. Also, talking a little bit farther away may help. You will find that condenser mikes have plenty of output, so you don't need to talk real close.

In case you're wondering, yes, those $100 desk mikes use the same $2 condenser mike cartridges! Of course, they have nice cabinets and acoustic chambers which help shape the sound quality. And they also might have tone controls, PTT switches, etc. But you can make your own for very little money, and it will perform about the same, especially if you experiment a little with the acoustic chamber in which the cartridge is mounted. Heck, even with no chamber at all, condenser mikes sound pretty good.

Well, that about does it for microphones. Now, let's look at a letter:

Dear Mike,

When making an in-circuit test with a voltmeter or ohmmeter, is it always necessary to remove one lead of the component you're testing? In repair shops, is there a lot of desoldering, testing and resoldering going on?

Signed,
Leg Puller

Dear Leg,

Whether or not you have to disconnect one leg of the circuit depends on the test you are doing. If you want to know the voltage on a point while the questionable part is connected, then you don't pull anything. That's the most common first test. If, however, that test shows something suspicious, such as zero volts, then you may want to pull one leg of the suspect part and retest, in order to see if it makes any difference. If the voltage rises, the part may be shorted.

To measure a part's resistance, you usually do pull it. Otherwise, other components may fool the test, and residual voltage from the power supply's capacitors could even damage your ohmmeter.

To measure current, you must always connect the ammeter in series with the circuit, so you must disconnect something.

See you all next month. RF

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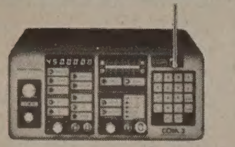

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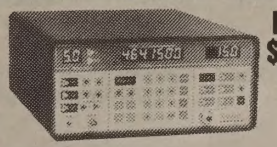

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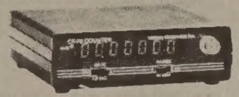

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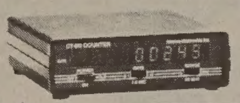

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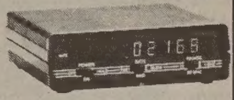

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CT-125	10 Hz–1.25 GHz	<25mV to 50 MHz <15 mV to 500 MHz <100 mV to 1 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$189.95
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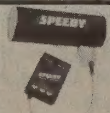

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PR-2, wired, includes AC adapter	$59.95

2M POWER AMP

Easy to build power amp has 8 times power gain, 1W in, 8W out, 2W in, 16W out, 5W is for 40W out. Same amp as featured in many ham magazine articles. Complete with all parts, less case and T-R relay.

PA-1, 40W pwr amp kit	$34.95
TR-1, RF sensed T-R relay kit	$11.95

FM WIRELESS MIKE KITS

FM-3 SHOWN

Pick the unit that's right for you. All units transmit stable signal in 88-108 MHz FM band up to 300' except for hi power FM-4 that goes up to 1/2 mile.

FM-1, basic unit	$5.95
FM-2, as above but with added mike preamp	$7.95
FM-4, long range, high power with very sensitive audio section, picks up voices 10' away	$14.95
MC-1, miniature sensitive mike cartridge for FM-1,2,4	$2.95

MICROWAVE INTRUSION ALARM

A real microwave Doppler sensor that will detect a human as far as 10 feet away. Operates on 1.3 GHz, and is not affected by heat, light, or vibrations. Drives up to 100 mA output, normally open or closed, runs on 12 VDC.

Complete kit MD-3	$19.95

MUSIC MACHINE

Neat kit that will produce 25 different classical and popular tunes, plus 3 doorchime sounds. Lots of fun for doorbells, shop, or store entrances, car horn, music boxes, etc. Runs on 9V battery or wall transformer. Excellent speaker volume and adjustable tempo and pitch. Add our case set for a handsome finished look.

Complete kit, MM-5	$24.95
Case + knob set, CMM-5	$12.95

PACKET RADIO

Two new versions are available for the Commodore 64 (P-64A) or the IBM-PC (P-IBM). Easy assembly "NO TUNING". Includes FREE disk software, PC Board and Full Documentation.

KIT	P-64A	$59.95
	P-IBM	$59.95
CASE	CPK	$12.95

LO NOISE PREAMPS

Make that reciever come ALIVE! Small size for easy installation with Hi-Q tuned input for peak performance. Excellent gain and noise figure—guaranteed to improve reception! Specify band: 2M—PR-10, 220 MHz—PR-20, 440 MHz—PR-40.

Each kit	$17.95

TONE DECODER

A complete tone decoder on a single PC board. Features: 400–5000 Hz adjustable range via 20-turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.

Complete kit, TD-1	$6.95

VOICE ACTIVATED SWITCH

Voice activated switch kit provides switched output with current capability up to 100 mA. Can drive relays, lights, LED, or even a tape recorder motor. Runs on 9 VDC.

VS-1 kit	$6.95

TELEPHONE TRANSMITTER

Mini-sized with professional performance. Self-powered from phone line, transmits in FM broadcast band up to ¼ mile. Installs easily anywhere on phone line or inside phone!

PB-1 kit	$14.95

NEW

SPEAKER PHONE

Talk on the phone hands-free, great to put in shop or shack, press the button to answer—no actual phone needed. Works same as commercial units. Talk from anywhere in room, phone line powered—no battery needed. Super for family and conference calls or buy two for hands-free intercom! Add our case set for a pro look.

SP-1	$29.95	Case-CSP	$12.95

TICKLE STIK

A shocking kit! Blinking LED attracts victims to pick up innocent-looking can—you watch the fun! Ideal for office desks, parties, nosey know-it-alls!

TS-4 kit	$9.95

LIGHT BEAM COMMUNICATORS

Transmits audio over infrared beam up to 30'—use simple lenses to go up to ¼ mile! Hum free, uses 30 kHz carrier. Great for wireless earphones or undetectable "bug."

Transmitter + receiver set, LB56	$19.95

FM RADIO

Full-fledged superhet, microvolt sensitivity, IC detector and 10.7 MHz IF. Tunes Std. FM broadcast band as well as large portions on each end. Ideal for "bug" receiver, hobby experiments or even as FM radio!

FR-1 kit	$19.95

SUPER SLEUTH

A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2W rms output. Runs on 6 to 15 volts, uses 8–45 ohm speaker

BN-9 kit	$6.95

BROADBAND PREAMP

Very popular sensitive all-purpose preamp, ideal for scanner, TVs, VHF/UHF rigs, counters. Lo noise, 20 dB gain, 100 kHz–1 GHz, 9V–12 VDC operation.

SA-7 kit	$14.95

•2 METERS
•223 MHz
•440 MHz

$149⁹⁵

FANTASTIC FM TRANSCEIVERS

SYNTHESIZED—NO CRYSTALS

Ramsey breaks the price barrier on FM rigs! The FX is ideal for shack, portable or mobile. The wide frequency coverage and programmable repeater splits makes the FX the perfect rig for Amateur, CAP or MARS applications. Packeteers really appreciate the dedicated packet port, "TRUE-FM" signal and almost instant T/R switching. High speed packet? ....No problem. Twelve diode programmed channels, 5W RF output, sensitive dual conversion receiver and proven EASY assembly. Why pay more for a used foreign rig when you can have one AMERICAN MADE (by you) for less. Comes complete less case and speaker mike. Order our matching case and knob set for that pro look.

FX-146 kit (2 Meters)	$149.95
FX-223 kit (1¼ Meters)	$149.95
FX-440 kit (3/4 Meters)	$169.95
CFX matching case set	$ 24.95

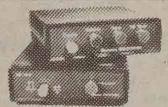
2 MTR & 220 BOOSTER AMP

Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output, allowing you to hit the repeater's full quieting while the low noise preamp remarkably improves reception. Ramsey Electronics has sold thousands of 2 meter amp kits, but now we offer completely wired and tested 2 meter, as well as 220 MHz, units. Both have all the features of the high-priced boosters at a fraction of the cost.

PA-10 2 MTR POWER BOOSTER (10 X power gain) Fully wired & tested	$89.95
PA-20 220 MHz POWER BOOSTER (8 X power gain) Fully wired & tested	$89.95

QRP TRANSMITTERS HAM RECEIVERS

20, 30, 40, 80M CW TRANSMITTERS



Join the fun on QRP! Thousands of these mini-rigs have been sold and tons of DX contacts have been made. Imagine working Eastern Europe with a $30 transmitter—that's ham radio at its best! These CW rigs are ideal mates to the receivers at right. They have two-position variable crystal control (one popular QRP XTAL included), one watt output and built-in antenna switch. Runs on 12VDC. Add our matching case and knob set for a handsome finished look.

Your choice of bands (Specify band: QRP-20, 30, 40 or 80)	$29.95
Matching case & knob set, CQRP	$12.95

20, 30, 40, 80M All Mode RECEIVERS

Build your own mini ham station. Sensitive all-mode AM, CW, SSB receivers use direct conversion design with NE602 IC as featured in *QST* and ARRL handbooks. Very sensitive varactor tuned over entire band. Plenty of speaker volume. Runs on 9V battery. Very EASY to build, lots of fun and educational—ideal for beginner or old pro. New 30-page manual. Add the case set for well-fitted professional look.

Your choice of bands (Specify band: HR-20, HR-30, HR-40, HR-80)	$29.95
Matching case & knob set, CHR	$12.95

E-Z KEY CMOS KEYER

Send perfect CW within an hour of receiving this kit! Easy-to-build kit has sidetone oscillator, speed control and keys most any transmitter. Runs for months on a 9V battery. 28-page manual gives ideas on making your own key for extra savings. Add our matching case set for complete station look.

CW-7 kit	$24.95
Matching case knob set, CCW	$12.95

ACTIVE ANTENNA

Cramped for space? Get longwire performance with this desktop antenna. Properly designed unit has dual HF and VHF circuitry and built-in whip antenna, as well as external jack. RF gain control and 9V operation makes unit ideal for SWLs, traveling hams or scanner buffs who need hotter reception. The matching case and knob set gives the unit a hundred dollar look!

AA-7 Kit	$24.95
Matching case & knob set, CAA	$12.95

SPEECH SCRAMBLER

Communicate in total privacy over phone or radio. Kit features full duplex operation using frequency inversion. Both mike and speaker or line in/out connections. Easy hookup to any radio, and telephone use requires no direct connection! Easy to build 2 IC circuit. Can also be used to descramble many 2-way radio signals. Finish your kit off with the handsome case & knob set.

SS-7 kit	$29.95
Matching case & knob set, CSS	$12.95

SHORTWAVE RECEIVER

Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4–11 MHz. True superhet has smooth varactor tuning, AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3–22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!

Shortwave receiver kit, SRI	$29.95
Shortwave converter kit, SCI	$27.95
Matching case set for SRI, CSR	$12.95
Matching case set for SCI,CSC	$12.95

2, 6, 10 MTR, 220 FM RECEIVERS

Keep an ear on the local repeater gang, monitor the cops, check out the weather or just plain listen around. These sensitive superhet receivers are just the ticket. They tune any 5 MHz portion of the band and have smooth varactor tuning, dual conversion with ceramic IF filters, AFC, adjustable squelch and plenty of speaker volume. Runs on 9V battery and performance that rivals the big rigs! For a complete finished pro look, add our matching case and knob set with screened graphics.

FM communications receiver kit	$29.95

Specify band: FR 146 (2m), FR6 (6m), FR10 (10m), FR-220 (220 MHz)

Matching case & knob set, CFR	$12.95

FM STEREO TRANSMITTER

Run your own stereo FM station! Transmit a stable signal in the standard FM broadcast band throughout the house, dorm or neighborhood. Connects easily to line outputs on CD player, tape decks, etc. Runs on 9V battery, has internal whip antenna and external antenna jack. Add our case set for a "station" look!

FM-10 kit	$29.95
Matching case set, CFM	$12.95

AIRCRAFT RCVR

Hear exciting aircraft communications—pick up planes up to 100 miles away! Receives 110–136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.

AR-1 kit	$24.95
Matching case set, CAR	$12.95

TERMS: Satisfaction guaranteed. Examine for 10 days. If not pleased return in original form for refund. •Add $3.75 for shipping, handling and insurance. •For foreign orders add 20% for surface mail. •COD (U.S. only), add $5.00. • Orders under $20, add $3.00. •NY residents add 7% sales tax. •90-day parts warranty on kit parts. •1-year parts & labor warranty on wired units.

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CIRCLE 34 ON READER SERVICE CARD

A DXpedition/Honeymoon

Brunei (V85OO and V85XYL), East Malaysia (9M6OO and 9M6BQ) and Hong Kong (VS6VO, VS6/N2OO and VS6/KF2BQ).

by Bob (N2OO) and Beth (KF2BQ) Schenck

Honeymoon/DXpedition! Boy! Those are two words I bet you thought would never show up in the same sentence, huh? Well, when Beth and I decided to get married . . . and the subject of a honeymoon came up . . . we thought it would be neat if we could combine the two. After all, I have DXpeditioning in my blood and Beth already knew that. We decided to do it, as long as the honeymoon part of the trip wasn't overwhelmed by the radio part. Thus, the planning began back in February 1991.

Beth would do most of the wedding planning with her Dad, Norm N2IRM, and Mom, Joan KB2EVF. I would be in charge of planning the honeymoon, although we both helped each other out in times of crisis! The wedding plans went along very well with many friends and relatives lending a hand. Bill N2EID was the Best Man. Dave and Margaret Burgess (WA2TVS and KB2BRR), and Bob and Nancy Wick (N2HM and KA2YNH) would do the wedding video as well as help with the reception. Keith N2FQB would be our disc jockey and provide the reception entertainment. Tony KT2W would be in charge of the champagne pourers! Tom N2LDE would be our photographer. (I guess it wouldn't surprise you if I was to tell you that Beth and I met at the local radio club, the Old Barney Amateur Radio Club.)

My job was a lot bigger than most thought it would be. What had begun as a plan for a three-week honeymoon quickly lengthened to five weeks, thanks to airline schedules. I had a free airline ticket to the Orient available to me through my frequent flier club. Only problem was that all return flights were booked until five weeks after the wedding. Beth is a teacher, so time off in the summer was no problem. However, I work for the local telephone company and I had four weeks vacation saved for the honeymoon. Fortunately, I was allowed to take the additional week off without pay since it was for my honeymoon.

First Stop: Rawa Island, 9M2 Land

Our first stop was arranged by my old friend Tunku Mahmood Shah V85MS/9M2MS (Moody). I hadn't seen Moody since 1980 when I was in Brunei on my second visit there as VS5OO. My first visit was in 1979 when I operated from Moody's place, also VS5OO. Moody was of great help to us in 1979. He helped us put the 1S1DX DXpedition together. Moody is a member of the royal family in Johor, Malaysia, and they own a small resort island in the South China Sea called Rawa Island. Moody had told me of the island over the years and it sounded like a nice place for our first week as Mr. and Mrs.. Beth and I agreed that the first week would be without radio, so we spent seven days between Singapore, Johor and Rawa, mostly alone on the tropical island, sipping cool drinks on the porch of our beach-front chalet and bobbing in the South China Sea. Thank you, Moody, for the wonderful time on Rawa.

Next Stop: Brunei Darussalam, V85 Land

Beth and I decided that Brunei would be our primary radio stop on our five-week honeymoon. I really wanted Beth to hear the other side of a pile-up. To make sure that we would be successful I had arranged with Bill V85AA to stay with him and his lovely XYL, Lita V85LM. I had visited Bill in 1990 and operated as V85OM using his station, but his antennas were only dipoles. He had an 80-foot tower laying in his back yard but no antennas for it. So, we arranged a mutually beneficial deal with Bill. If he got the tower up, I would get him a good antenna for it. So Bill went to work. First off, Bill located the old 204BA 20 meter 4-element monobander left after the Spratly trip in 1979. It needed some parts which I got from Hy-Gain promptly and shipped over to him air express. In addition to the parts, I sent a 155BAS, 5-element 15 meter yagi to Bill.

Photo B. The antenna farm at V85AA/V85LM, where we operated from during our honeymoon, 5 elements on 15 meters and 4 elements on 20 meters at 80 feet.

When we arrived on August 5th, we were greeted with the awesome sight of the stacked monobanders sitting at 80 feet. The only problem was that Bill couldn't locate a rotor, so we had them fixed due north with a sloping dipole favoring long path to the south. We also found the 10 meter 3-element beam from Spratly but it was too late for the parts to be shipped over so we opted not to operate on 10. Conditions were not good on 10 in August anyhow, so we didn't miss much. The 40 and 80 dipoles were also in place. Bill V85AA sure went above the call of duty to make sure that V85OO and V85XYL would be heard around the world!

Beth and I stayed at Bill's for seven days and made some 5,500 QSOs. We did manage to get out to see a little of Brunei the last couple of days, but we primarily played radio most of the time when conditions permitted. Bill also arranged for many visits from other local hams. Among those who visited were V85PE, V85GA, V85CA, V85HG and V85FC. Special thanks to Bill and Lita for their warm hospitality, and a big thanks to Joseph V85FC who lent us his rig when Bill's voltage regulators pooped out in his TS-930.

Photo A. At our operating position in Brunei, where we operated as V85OO and V85XYL, making 5,500 QSOs.

Next Stop: Sabah, East Malaysia, 9M6 Land

On August 12th we boarded the Royal Brunei Airlines plane for the 30-minute flight to Kota Kinabalu, Sabah, East Malaysia. Waiting at the airport were our hosts: Alfons and Doris (9M6MU and 9M6DU), Stephen and Senny (9M6ET and 9M6IQ), and Singh (9m6MX). I had first met Alfons when I was in Sabah in 1980 with Gary N2CW (SK), Alan VS5TX/VS6KY, and John KP2A. We operated from Alfons' place as 9M6MU and made 20,000 QSOs.

Over the years, I kept in touch with Alfons by writing an occasional letter and in 1989 we arranged for a return visit, bringing along my buddies Jim WB2KXA and Al and Ann, K8CW and KA8TKB, for a full-blown operation as 9M6OO. Our Sabah friends took the opportunity to tie our visit in with the official "Visit Malaysia Year—1990" by holding a banquet in our honor. The banquet, sponsored by the Sabah Amateur Radio Transmitter Society, was attended by the Chief Minister of Sabah and a bevy of other political VIPs. Amateur radio shined that evening in Sabah.

I also went to Alfons' location in November 1990 for what turned out to be my last "Bachelor DXpedition," also as 9M6OO.

So, returning to Sabah with my new bride was only natural! And my friends didn't let us down. After a wonderful Chinese dinner in Kota Kinabalu (KK), we were whisked away to Alfons' place in Keningau, some 80 miles deep in the heart of Borneo. The next four days had us doing an assortment of things, including making about

2,000 QSOs. We visited local sights, had dinners with some local friends, and Beth even visited a local school where she got a chance to teach a short lesson to the school children. After our four days, we went on a long trip to Mount Kinabalu, the tallest mountain in Southeast Asia, where we got to hike through the National Park's rain forest. Next, it was back to KK to meet up with our friends again for a farewell dinner before heading on to Singapore.

Thank you 9M6MU, 9M6DU, 9M6ET, 9M6IQ, 9M6MX, 9M6CS for a lovely time in Sabah.

Next Stop: Singapore, 9V1 Land

Singapore was our next stop, with a four-day visit planned. After settling in at the Hotel Phoenix, we spent a day recovering from assorted ailments probably picked up while in Sabah. We both recovered in time for a city tour and a visit to the Jarung Birdpark. We also got a chance to stop in with Dick 9V1YQ and connect with our home-town ham friends with whom we tried to maintain a daily schedule. Singapore was to be all honeymoon and again *no radio*. It was nice to get the chance to relax for four days and finally do a little souvenir shopping. It was also nice to eat some more recognizable food at such establishments as McDonald's, Pizza Hut etc. We even found an English pub, where we had our first steak in three weeks! It was great. But the four days went too quickly and it was time to catch another plane, this one bound for our last stop, Hong Kong.

Last Stop: Hong Kong, VS6 Land

On the flight to Hong Kong, we began to think that we were getting a little homesick. But I assured Beth that we were about to visit one of the most intriguing cities of the world, *and* there would be lots of shopping to do! We would not be disappointed.

Our host in Hong Kong, Graham VS6VO, and his lovely YL Eileen, were wildly waving to us as we arrived in the arrival hall at the Hong Kong airport. What was to follow was a truly memorable visit.

The first point of business, as usual, was to procure the ham licenses. However, arriving on a Saturday afternoon made us miss the telecoms office being open by about an hour. Since Monday was a local holiday, we would have to wait until Tuesday to get our own licenses. You can only get a reciprocal license in Hong Kong "in person" as I learned the hard way. However, Graham graciously allowed us to use his call until we got our own; thus we operated as VS6VO from Saturday, August 24th, through Tuesday, August 27th, after which we operated as VS6/N2OO and VS6/KF2BQ (once we got our own licenses in hand).

Graham and Eileen, along with a non-ham friend named Dan, took us on a Chinese junk ride around the waters of Hong Kong, with an evening visit to Lamma Island for a fresh seafood dinner. We picked our dinner out from live fresh fish in tanks and had them cooked to our order. It was a shabby-looking place as seen from the water, but once inside it appeared to be fairly nice; definitely a little rustic but clean and quaint! Magnificent!

The following week was filled with an assortment of sightseeing, dining, shopping and of course, ham radio. Now, a little about the station we used in Hong Kong: It was the best I had ever operated from on any of my trips. First off, we were on the 30th floor of a 30-floor apartment building in the Pok Fulam section of Hong Kong. Therefore, the 4-element tribander on the roof sat about 450 feet above the ground. We were the highest and just about the only building in the area and there was a clear shot in all directions. The best direction favors long path with a direct shot over water, but to the north the path stateside was between two mountain peaks. The rig was a TS950S at full legal output power. Signal reports were outstanding from all points as we were able to squeeze about 2,500 QSOs from a very busy schedule in Hong Kong. It was neat, and quite frustrating to be able to work XY0RR on one call when they first came on the air since I only needed Burma and Afghanistan to complete DXCC back home. (I fortunately got back in time to work them from home!)

We got quite proficient in getting around Hong Kong on our own after Graham had taken us around town on the weekend we arrived. Beth and I had a ball wandering around Kowloon shopping and taking in all the sights.

Finally, on the last full day in Hong Kong, we were able to hook up with my old friend Alan VS6KY who runs a small electronics business in Hong Kong. He has also opened a new office in New Zealand where his family now resides. Alan treated Beth and I to dinner aboard one of the floating restaurants in Aberdeen called the "Jumbo." This is a rather famous place. I can remember seeing it in numerous

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ASTRON POWER SUPPLIES

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PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105-125 VAC
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- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

SL SERIES

MODEL	Colors Gray	Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• LOW PROFILE POWER SUPPLY						
SL-11A	•	•	7	11	2¾ x 7⅝ x 9¾	11

RS-L SERIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE				
RS-4L	3	4	3½ x 6⅛ x 7¼	6
RS-5L	4	5	3½ x 6⅛ x 7¼	7

RM SERIES MODEL RM-35M

• 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL	Colors Gray	Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46

MODEL RS-7A

RS-M SERIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46

MODEL RS-35M

VS-M AND VRM-M SERIES

• Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

MODEL VS-35M

RS-S SERIES

• Built in speaker

MODEL	Colors Gray	Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18

MODEL RS-12S

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

Photo C. We visited the shack of Hassan V85HG.

Photo E. While in Singapore, we visited with Dick 9V1YQ. Here is Dick showing off his old Collins and his Coca Cola can collection from all over the world.

Photo D. Here we are operating from Sabah as 9M6OO and 9M6BQ, where we made 2,000 QSOs in three days of limited operating.

movies and TV shows over the years and although I had been in Hong Kong several times, I had never seen the "Jumbo." It was quite an attraction! Very glittery and highly decorative. Definitely a *tourist* attraction, but the food wasn't bad at all! Another sight I had never visited before was the tram to The Peak. I promised Beth that we would do that! Graham dropped us at the base station where we boarded the tram, then he drove to The Peak to meet us there for a lunch with a panoramic view of all of Hong Kong and Kowloon. Although it was a hazy day, the view was spectacular.

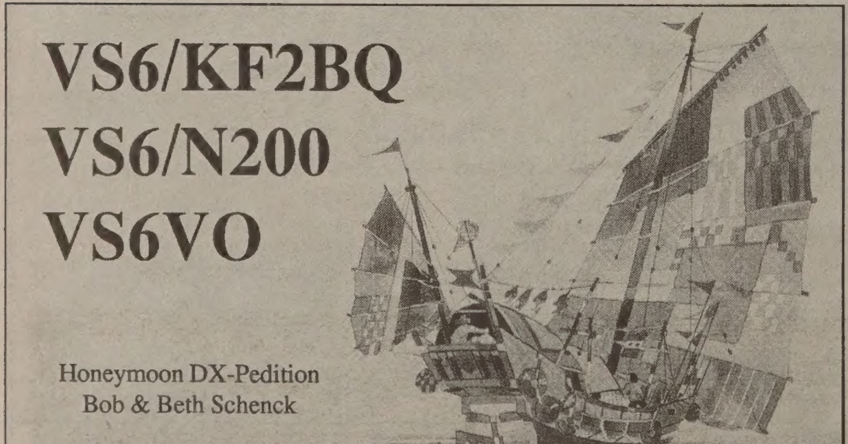
Our visit to Hong Kong capped off a truly wonderful trip; all made possible by amateur radio. Thank you, Graham VS6VO, Eileen and Wilma, and Alan VS6KY for the wonderful hospitality!

Next Stop: Home

Needless to say, our honeymoon/DXpedition was truly a success. Beth and I had a wonderful time as we wandered around some of the most unique and beautiful places in the world. Amateur radio is how we met, so it was fitting that we would share at least a part of our honeymoon with the ham radio community. It was thrilling every time, while in the middle of a pile-up, to hear "congratulations to the newlyweds" greetings coming to us from all corners of the world. It made our new start in life seem so very, very special.

A special thanks must go to Jim WB2KXA and Rich KD2KS who maintained a twice-daily schedule with us so that we could keep in touch with our friends and families back home.

To all who wished us well, thank you from the bottom of our hearts for all your kind wishes, and Beth and I hope we will have the chance to work you all again if we are ever able to travel on our "second honeymoon/DXpedition." RF



VS6/KF2BQ
VS6/N200
VS6VO

Honeymoon DX-Pedition
Bob & Beth Schenck

HONG KONG

Honeymoon DXpedition QSL.

Photo F. Here is our host in Hong Kong, Graeme VS6VO, at the controls of his station (on which we made some 2,500 QSOs).

what next?

by Carole Perry WB2MGP

Let Them Have Fun While They're Learning

Bob Baker KQ1K is a science and math teacher at the Mattacheese Middle School in Yarmouth, Massachusetts. Bob shares with me the belief that youngsters in middle schools, who are generally 10–14 years of age, tend to be overstimulated and underworked. It's a real challenge for teachers of this age group to keep their students highly motivated and eager to come to class. Amateur radio allows the creative teacher to stimulate children's interests in a myriad of subject matter and to get every single youngster involved and mastering new skills. Children who enjoy participating in the radio activities leave the class feeling good about themselves. Building self-esteem in youngsters is the first building block in learning.

The following is a piece that Bob wrote for me to share with other teachers or instructors who may be considering bringing amateur radio into their classrooms, or who may be interested in working with a youth group after school. The rewards of helping young people become excited about learning are terrific. If you are considering this as a possibility in your school, please call me or write to me so that I can have a chance to assure you what a good idea it is. There are many resources and materials available to help you through the curriculum, so you don't have to feel as though you're out there alone.

"Enclosed are some pictures of the kids using the Codekey code practice oscillators. They have been a big hit and work just great for the code. It's a terrific teaching tool and the children really like using them. We're just about ready to give them the code test and the theory exam. Several are ready to pass the code right now.

"These youngsters range in age from 10 to 13 years. The youngest is 10 and is the brother of a student who was in last year's Novice class. John Gilligan was promised a radio station at home by his mom and dad if both he and his sister Kelly would get licensed. Well, both children did just that and are now enjoying their ham shack at home. Kelly is the most active ham in the school. During her lunch period, she goes down to the school station and works DX while eating her lunch. Every day Kelly can be found munching on her sandwich as she scans the Novice portion of 10 meters and works new stations.

"All the children in the photo have been on the air with KQ1K and have talked with amateurs from all parts of the country and around the world. Almost all the hams we've contacted have gone out of their way to be nice to the children. They engage the youngsters in conversation and give them valuable advice about the hobby. Most of the children are shy at first, but the warm way in which the hams greet them soon sweeps away any shyness they may have about getting on the mike. The kids also help publish the newsletter for the local amateur radio club in the area. The instructor has a desktop publishing program and does all the layout. It's duplicated at school on club paper. The kids attach mailing labels, staple the pages, and pack the newsletters for mailing to over 200 members of the Barnstable Radio Club. The club pays the school children for this service. This enables the kids to raise some extra money to buy radio gear for the school station. The kids feel they have helped to *earn* money for their middle school station, and the radio club feels that they are helping to provide a means for the children to earn their own money for radio equipment. Needless to say, everyone is very happy with this arrangement. Through donations and money earned, the Mattacheese Middle School now has a 40-foot tower with a tribander antenna and a Kenwood HF transceiver donated by the Parents' Council."

Bob and his class can be heard on the air on Thursday afternoon between 3:30 and 4:30 local time between 28.400 and 28.495 MHz. Another reminder: Look for Gordon West WB6NOA and myself with the children from Intermediate School 72 in Staten Island, New York, on the CQ All Schools Net on Tuesdays and Thursdays at 17:30 UTC on 28.303 MHz. Help welcome the new young people into the fun of amateur radio. **RF**

Bob Baker KQ1K and his students at Mattacheese Middle School in Yarmouth, Massachusetts.

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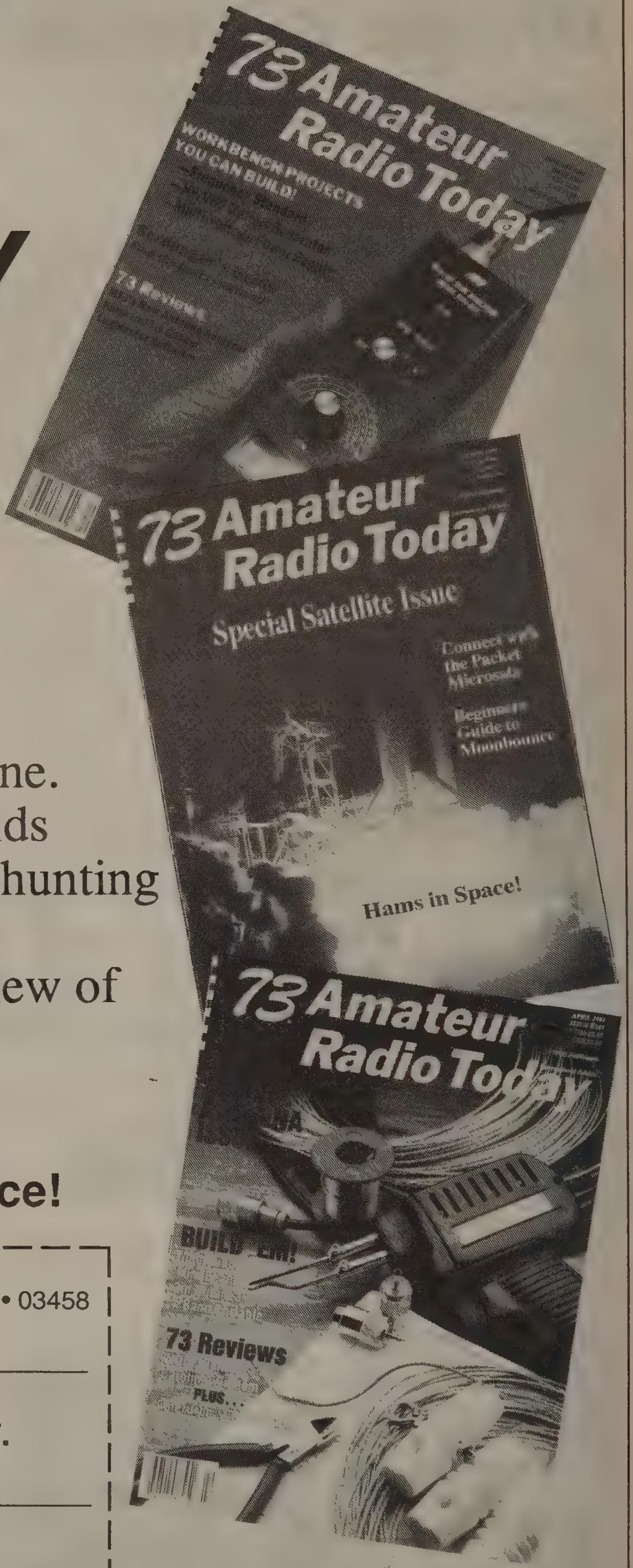

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A 10 Meter Folded Dipole Antenna

by Ed Marriner W6BLZ

The length of a folded dipole can be found using the formula 468/freq(MHz), which will give the length of the dipole in feet. The length of 16 feet 6 inches is a good compromise for the whole of 10 meters. There are several advantages to using a folded dipole. First, it is a broadband device. This is good for 10 meters where the operating range is from 28.0 MHz to 29 MHz. The next advantage and most desirable characteristic is that it does not accept power at twice the fundamental frequency. This means that it should attenuate the TV channel two harmonic providing there is no capacitive coupling at the tuning end. Cutting the feeders 22–32 feet long or the length 52–64 feet long will also help.

The folded dipole does not accept power at even multiples of the fundamental because the folded section acts as a continuation of a transmission line. The folded dipole is better than a single dipole because the current in the two conductors flows in the same direction and acts as two conductors in parallel; therefore, the current in each conductor is divided. Thus, the feedline sees a higher impedance because it is delivering the same power at half the current and the impedance is about four times greater at the feed point than a regular dipole. This enables us to use 300 ohm twin lead to feed the antenna.

The folded dipole antenna mounted in a vertical position with the bottom 12 to 24 inches off the ground offers a low angle of radiation and probably a lower angle than most beams, although, without the gain. The lower angle is really an advantage when reaching out for the extreme DX. The all-around pattern is also an advantage for SSB roundtable discussions.

For the investment, the vertical folded dipole is a good solution for those who do not want to put up a beam for the short period of years 10 is open.

Construction

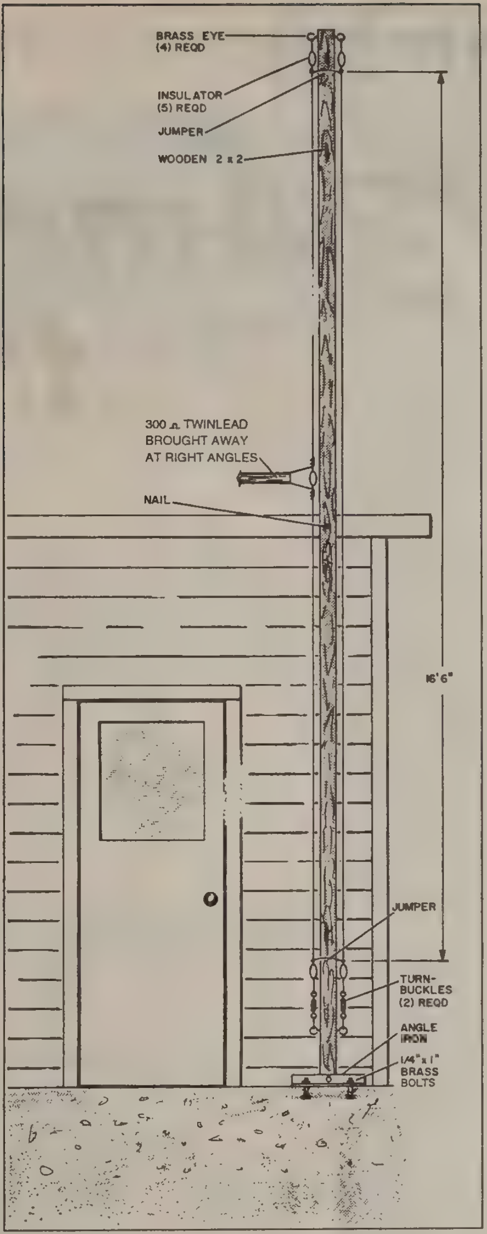
Take a trip to the lumber yard and buy a 20-foot 2 x 2 and give it an undercoat and three coats of Z-Spar boat paint. Put two brass screw eyes at the top of the pole and two at the bottom a sufficient distance away to accommodate the length of wire and insulators plus turnbuckles. String the wire on each side of the 2 x 2 between the insulators and tighten the turn buckles. Solder jumpers on each end. The center insulators where the feedline is attached should be short. Wires can be soldered from it to several 6-32 machine screws on a piece of lucite which has been screwed to the 2 x 2 to help take the strain when the 300 ohm line is pulling. The 300 ohm twin lead should come away from the antenna about 10 feet. It can be held by end-slotting some sticks which are then nailed to the house or garage to support the line.

The antenna mast can now be nailed to the eaves of the house or garage. The bottom of the 2 x 2 can be bolted to an angle iron or aluminum four inches long which in turn can be bolted to concrete with 1/4 x 20 bolts set in the cement.

Since we're using balanced transmission line, it will be necessary to use an antenna tuner. You should get zero SWR throughout the whole of the 10 meter band with very little adjustment.

Does it work? Just as many G's, DLs, DJs, JAs, LU, VK, and ZLs have been worked with as much ease as with the old 4-element beam. For the few dollars investment for wood, paint and wire, compared with the beam, tower and rotor you can say that I am sold on it! **RF**

Reprinted from the May 1968 issue of 73 Amateur Radio.



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try something new

by Bill Brown WB8ELK

Reading Schematics, Part II

Last month we looked at two of the most basic components in a circuit: resistors and capacitors. This time we will go over some more components that appear frequently in circuits and how to decipher their schematic symbols.

Light Emitting Diodes

Light Emitting Diodes (or LEDs) are a special type of diode. Current only flows through the device in one direction. The junction point of the diode is made out of a special material which glows when current flows through it. This small glow is magnified by the plastic case that surrounds the junction. The symbol for an LED is that of a diode with a lightning bolt next to it to indicate light. You can tell which side is the cathode by a flat edge on the plastic case which should be nearest the longer of the two wire leads. (See Figure 1).

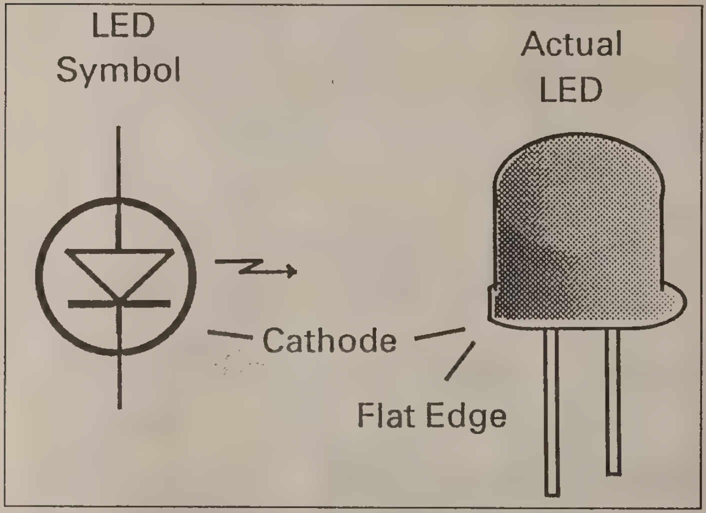


Figure 1. The light emitting diode (LED). The cathode is indicated by the flat side of the plastic case nearest the longest lead.

Batteries

The symbol for a battery is a series of long and short lines indicating the plates of a battery. The positive side is marked with a "+" symbol. The negative end of the battery usually goes to the ground point of a circuit. (See Figure 2.)

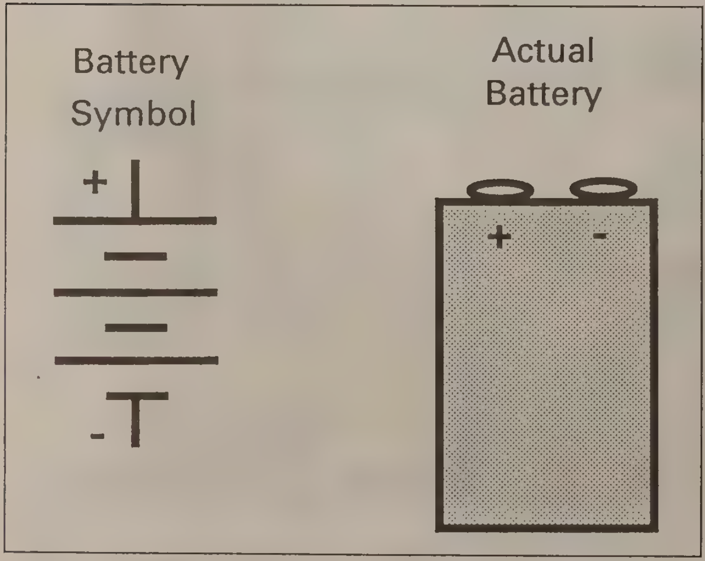


Figure 2. The battery power source.

Integrated Circuits

Integrated Circuits (ICs) usually come in what is known as DIP packages (Dual In-line Packages). They all have a specific function and come in a variety of pin configurations. One of the smallest packages is the 8-pin DIP variety. If you look at the top of the IC with the pins pointing down away from you, you will notice a small dot near one of the pins. Also, at one of the ends of the plastic housing you may see an indentation. Orient the IC with this indentation pointing up. The dot should now be in your upper left-hand position. The pin next to the dot is pin number 1. Each pin below pin 1 is in sequence (i.e. pin 2, 3 and 4). You then go to the bottom right-hand corner and count up from there. (See Figure 3.)

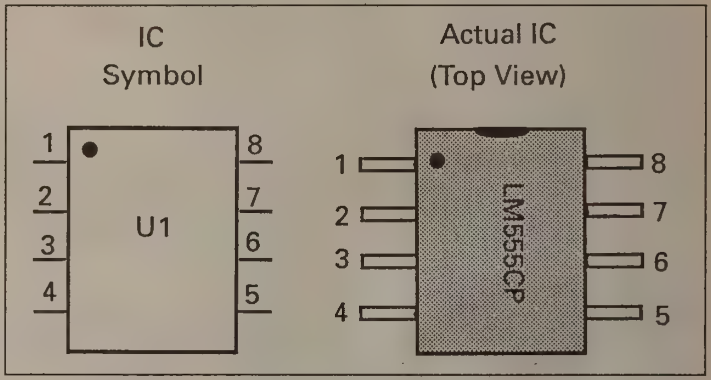


Figure 3. An integrated circuit (an 8-pin DIP version is shown).

Making Connections

Once you have all the components in place, you need to make the connections to turn it into a working circuit. Wherever there is a line between components in a schematic diagram, just attach a wire between the points. If the lines cross in a schematic, check to see if there is a dot at the intersection. If there is a dot, these wires need to be connected together. If there is no dot, or a loop, where the lines cross, there is no connection. See Figure 4 for the two types of intersections.

There are two more symbols you'll need to know in order to supply power to your circuit. To indicate the parts of the circuit that attach to the positive terminals of your battery or power supply, you'll usually find a small circle with "+ Vcc" or "+ 5V" next to it. You must connect all of these locations together and attach it to the positive terminal of your battery or power supply. Connect the locations marked by a "ground" symbol (see Figure 5 for power and ground symbols) and attach them to your battery or power supply's negative terminal. Since these points are very common in a circuit, they are shown separately in order to not clutter the schematic diagram with a maze of interconnections.

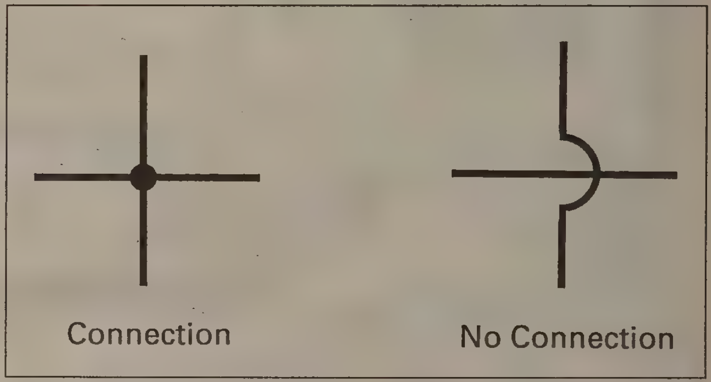


Figure 4. Showing wire connections. (a) A dot indicates the point where two or more wires connect. (b) A loop or NO dot indicates that the wires do NOT connect.

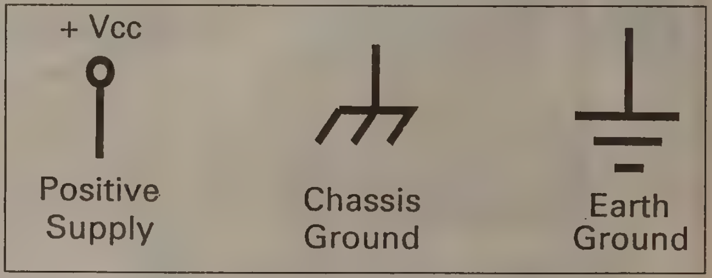


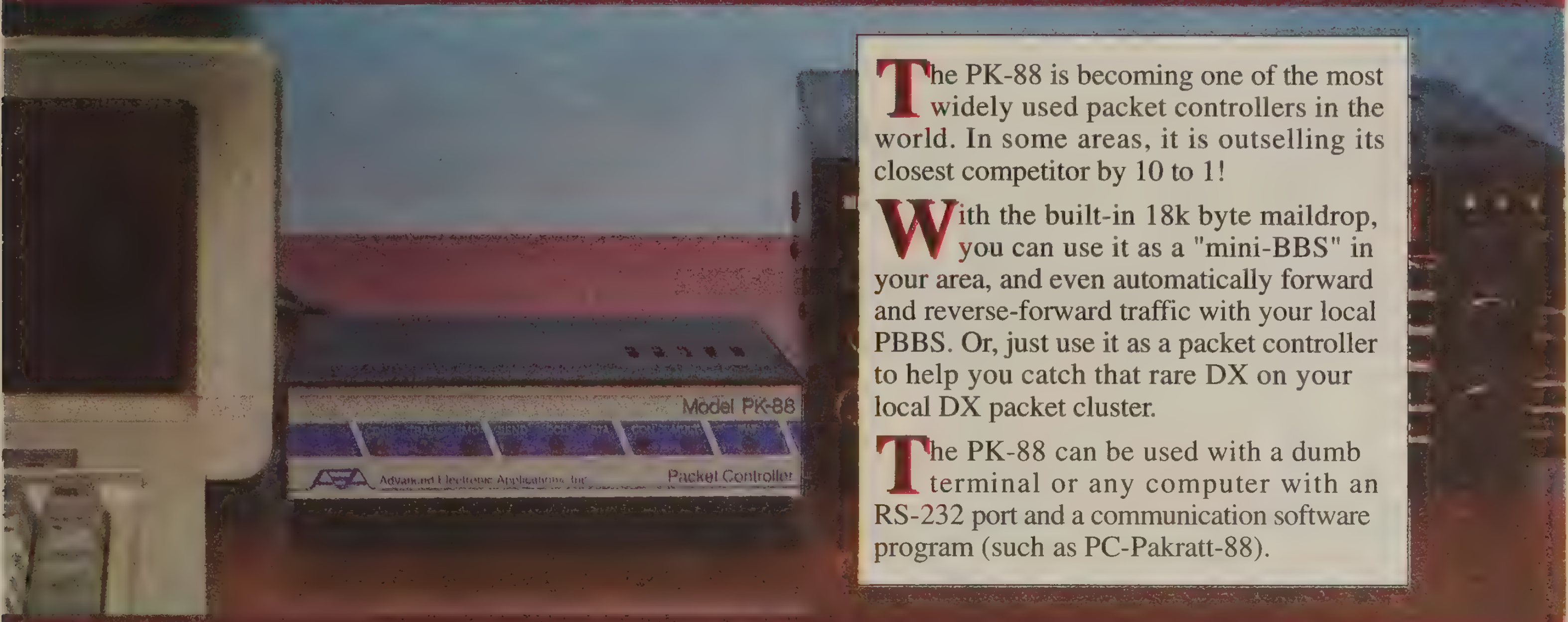
Figure 5. Power and ground connections.

Putting It All Together

I find that the easiest way to design or test out a circuit is to use a device called a solderless prototyping board. I recommend the following boards from Radio Shack: Universal Breadboard (RS# 276-169) or the Experimenter's Socket (RS# 276-174). You can also find these items in any of the mail order catalogs. If you plan on experimenting with large circuits, Jameco Electronics [phone:(415) 592-5097] has a nice prototype board (model #JE27). You just plug in components and use small jumper wires to make the connections between the components. A kit of different size jumpers is available from Radio Shack (RS# 276-173) as well as from the mail order catalogs. Circuit changes are just a matter of plugging or unplugging wires and components. The great advantage is that NO soldering is required. The Radio Shack prototype board contains 840 tie points with metal contacts underneath the board. The board has a series of 64 consecutive horizontal strips consisting of five holes each which are physically connected together underneath the board. This will allow you to make up to five connections to one intersection point.

Next month we'll take these components and put them together into a working circuit. We'll look at the schematic and how it would look using real-world representations. Once you get the hang of relating schematics to actual components you'll be building and designing circuits like the pros! RF

Now you see it....



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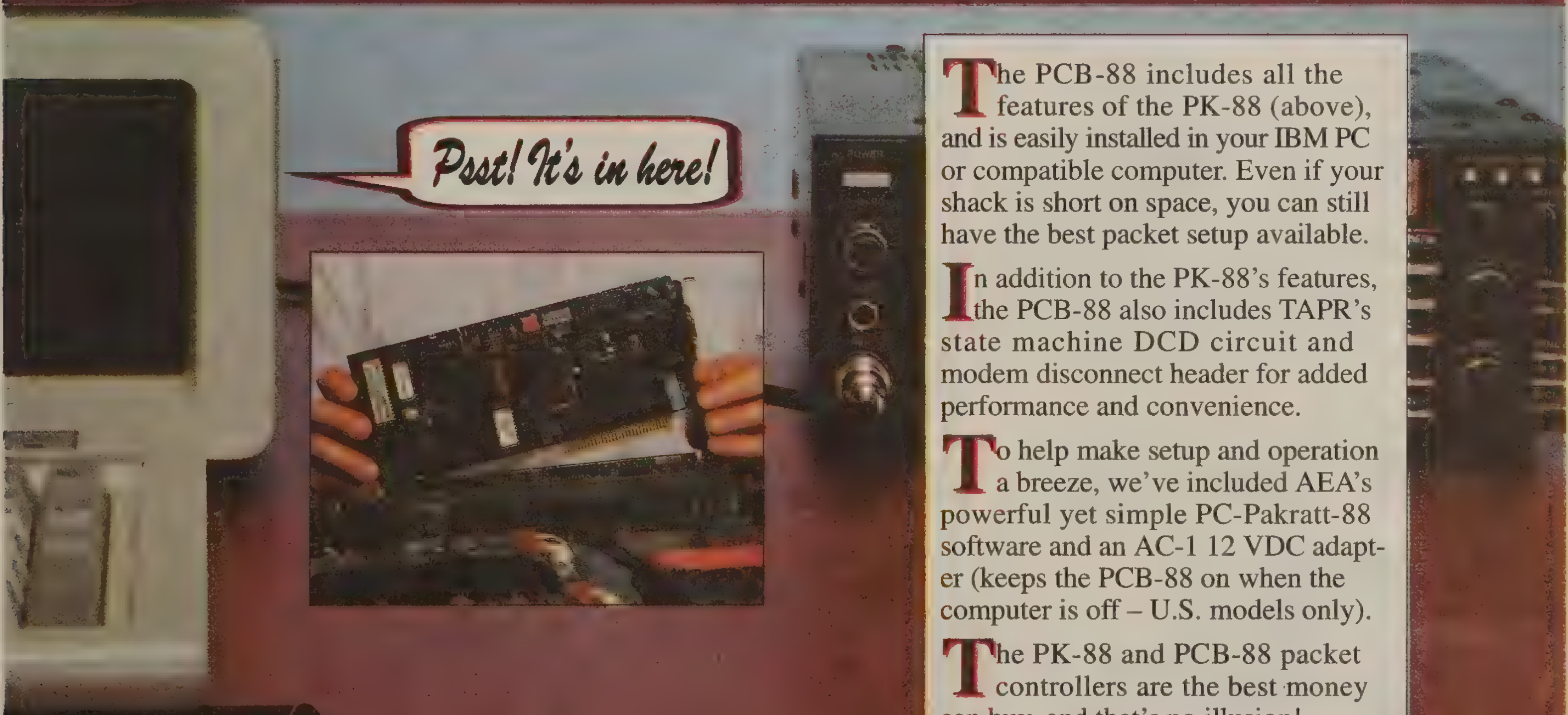
The PK-88 can be used with a dumb terminal or any computer with an RS-232 port and a communication software program (such as PC-Pakratt-88).

Now you don't.



The PCB-88 includes all the features of the PK-88 (above), and is easily installed in your IBM PC or compatible computer. Even if your shack is short on space, you can still have the best packet setup available.

In addition to the PK-88's features, the PCB-88 also includes TAPR's state machine DCD circuit and modem disconnect header for added performance and convenience.

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The Two-Hour, 2 Meter Beam

A simple five-element loop yagi.

by William Thornburg WB9TNW

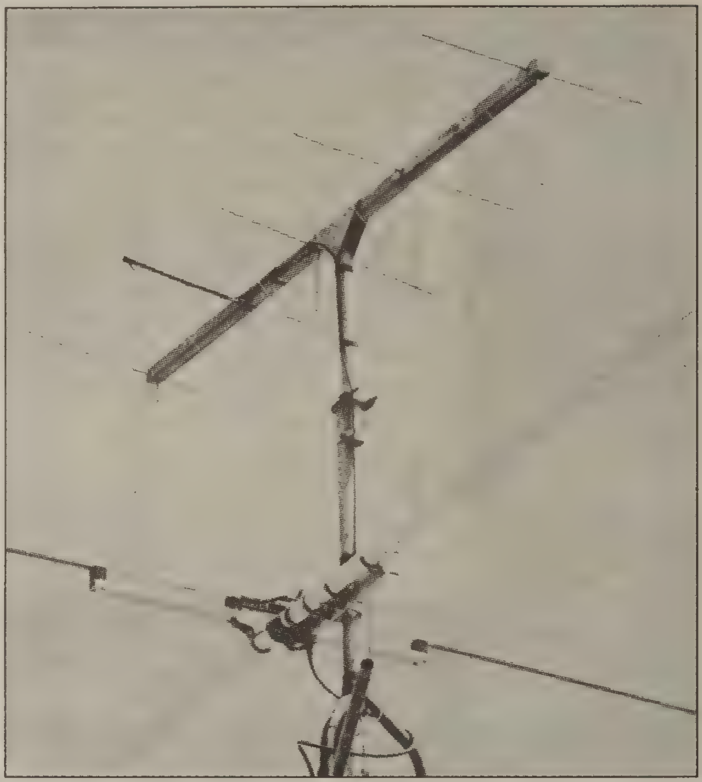
The quad, or loop, antenna is a special antenna to me. Perhaps this is because of its antiquity. I remember old movies on TV where wireless operators used receiving "loops." And, on an often traveled highway near my home, an amateur had a tremendous triband quad array. I didn't recognize it for what it was until many years later, but I knew it had something to do with radio.

My need for a 2 meter antenna became acute when I had to remove my old home-brew wooden-masted ground plane from my tower to make room for a new steel mast, rotor, and triband beam system.

The excitement of an HF beam caused a virtual end to 2 meter activity. After a few weeks, I rigged up a mobile antenna on the top of a bookshelf and was able to trip the local repeater. However, my rig is a 2-watt affair, and I began to get complaints of a scratchy signal.

It only took a couple of days of rummaging through the *ARRL Antenna Book* and the *Radio Amateur's Handbook* to arrive at a plan: a quad for 2.

I chose 146 MHz for a target frequency. The sizing of the passive elements is roughly a 3% series. For example, the reflector is about 3% larger than the driven element, the first director is about 3% smaller than the driven element, the second director is about 3% smaller than the first director, etc. For those desiring a different target frequency, use the formula (1005 x 12)/freq. in MHz to get the length of the driven element in inches, then scale the passive elements according to the 3% rules.



A person who is experimentally minded might "adjust and test" in an attempt to optimize this antenna. Factors such as taper ratio, element spacing, wire size, and feed system all or partially affect forward gain, SWR, feed impedance, bandwidth, and front-to-back. I was in a hurry and just slapped things together.

The construction of this antenna is simple, and the pictures tell it all. My old ground plane mast was an 8-foot two-by-two. I hacked it up into a 6-foot length for the boom and a 2-foot length for a shorty mast. The spreaders were made from 5/16" wood dowel stock. Another good material would be fiberglass arrow shaft stock. You could even use balsa or spruce sticks. The critical dimensions are in Table 1.

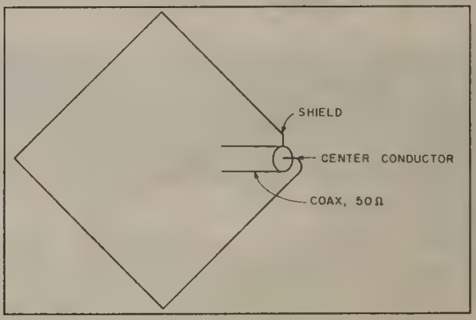


Figure 1.

The elements were made from 18 AWG solid copper wire. Plastic insulated wire could be used. Magnet wire from old television power transformers would be perfect, and the price is right.

Each element requires two spreaders, so I used an offset of about 0.5 inches when I drilled my holes in the boom. A drill press is the ideal tool for this job.

I made my spreaders a shade longer because I notched the ends with a moto-tool to accommodate the wire. You could use tape or string for the same purpose. I used epoxy to glue the spreaders in the two-by-two boom, using straight pins to hold some of the loose ones.

When cutting the wire, allow an additional inch or two. When you solder the loops closed, snip the excess wire off.

My 2-foot mast was butt-glued to the boom, and gusset plates of scrap 1/4" plywood were used. A few screws hold the wood together nicely while the glue hardens. The joint between the two-by-two mast and the pipe mast of my antenna installation was made using one U-bolt and one hose clamp because that's all I could find at that moment.

I used the diamond configuration, and feed was applied at a side corner to achieve vertical polarization. No special matching was attempted. I just connected the ends of the coax in the loop. (See Figure 1.) The passive elements are closed loops. The end of the coax could be potted with epoxy to keep water out. A touch of varnish would help preserve wood parts.

On the air, results were very satisfying. My friends report a 2 to 3 S-unit front-to-side and front-to-back ratio. In fact, with my 2-watt transmitter, I can hear stations that can't hear me.

According to the classical antenna theory, a 5-element yagi parasitic array has a forward gain of about 9.5 dB. This quad parasitic array seems to be behaving in a similar fashion. **RF**

Reprinted from the June 1978 issue of 73 Magazine for Radio Amateurs.

Table 1.

Element	Length (inches)	Dowel length (inches)	Inter-element spacing (inches)
Reflector	85	30	reflector to driven element–17
Driven element	83	29.3	driven element to first director–13
First director	80	28.3	first director to second director–16
Second director	77	27.2	second director to third director–21
Third director	74	26.2	

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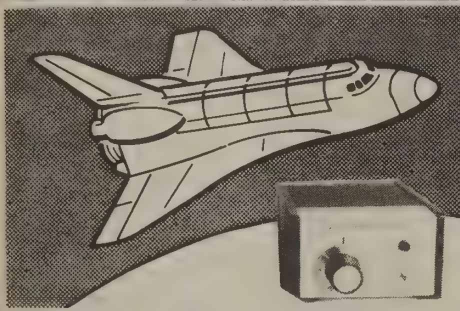

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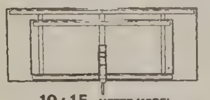

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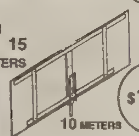

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Indoor Folding Dipole

You can put it anywhere.

by Gerald F. Gronson K8MKB

There are many antennas that can be used with an HT. Rubber ducks and pull-out whips are popular. There are also a number of mobile antennas or antennnas that are designed to be mounted on a tower or roof. This article describes a simple-to-make antenna, built with easy-to-obtain materials. Campers, apartment dwellers, vacationers: Anyplace where you need an antenna that you can't leave up, this will solve your problem.

The origin of this design is the old coaxial antenna, the one where you strip back a quarter wavelength of outer insulation and then fold back the braid to make a half-wave hangable dipole. It's simplicity itself—you only have to hang it up somewhere. Coaxial cable doesn't take to being rolled up too many times before it breaks, and, it's difficult to fold back the braid and not all that easy to tune the antenna to resonance. But, after a lot of figuring, grumbling, grinning and scratching, the "Folding Dipole" became a reality! It's easy to store, reasonably rugged, can be tuned without too much difficulty, and if it breaks, it's easy to repair.

The "I" Antenna

A tubing cutter is your main tool for this project. I recommend using a hobby knife and a low wattage soldering pencil. Start by stripping a two-foot piece of RG-59 about one inch back. Fold the braid back. Then strip about 3/8" of the center conductor. Using *stranded* speaker wire or zip cord, 22" long, make a "hook splice" onto the center conductor and solder. Take a second 22" length of stranded wire and strip one end about one inch, enough to go around the top of the braid, and solder. This arrangment forms a half-wave dipole for 2 meters.

Next, cut the PVC tubing as shown in the figure. It's a good idea to mark the PVC with a hobby knife deep enough for the wheel

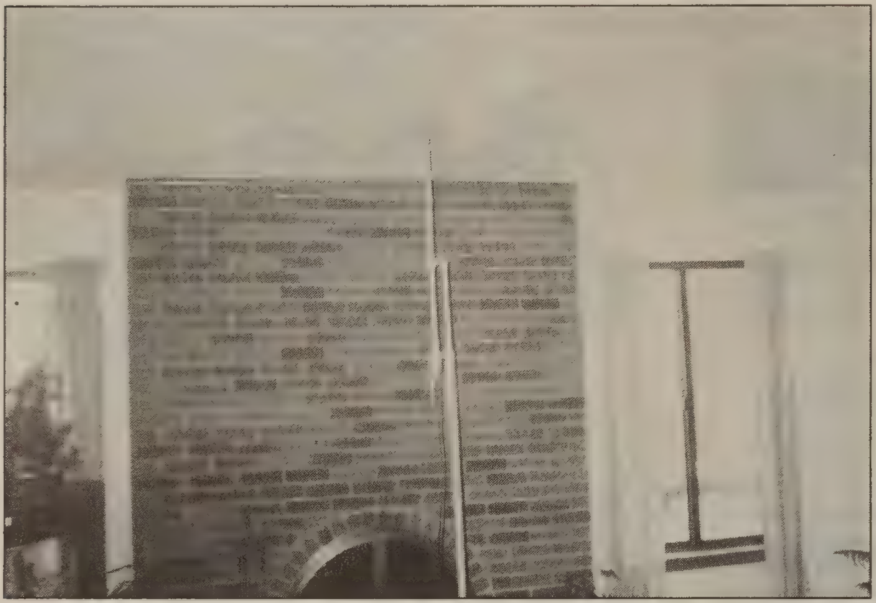

Photo A. The extended "I" antenna.

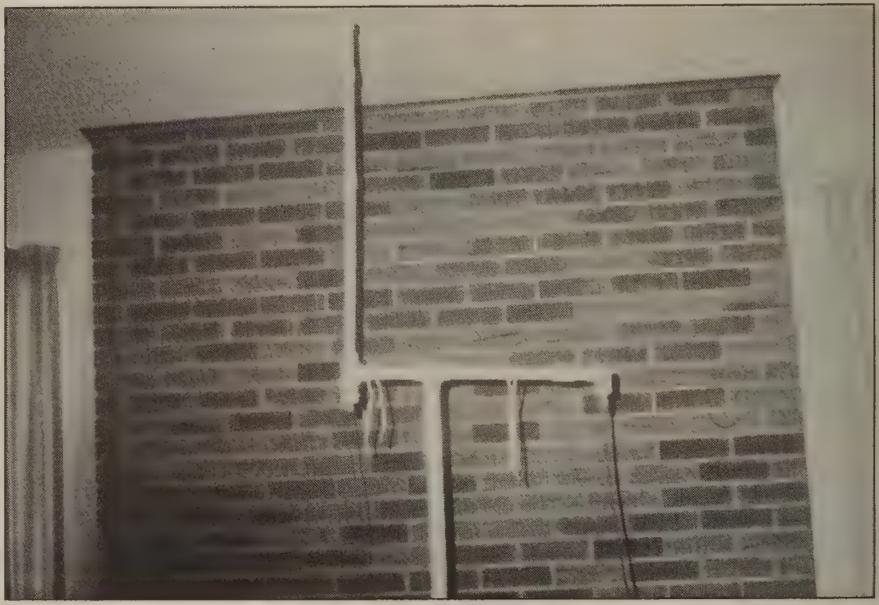

Photo B. The extended "L" antenna.

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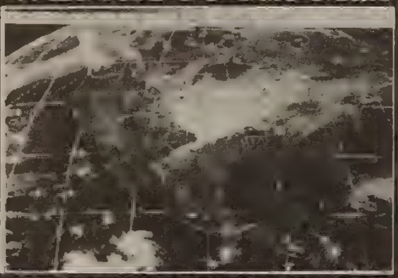

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Out on the project there are bunches of camels. So one day I took my rig out with me and I hung a 10 meter HalfSquare from poles stuck into the camel's saddle. Should have heard the laughs. But we had a bunch of camel-back QSO's back to the States that way. What? You don't have a camel for your HalfSquare? So string it up from what you've got! Add $5 P&H to your order.

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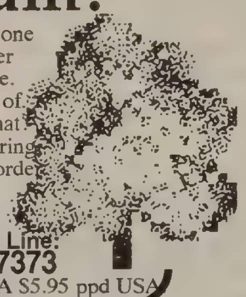

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Power rating is 200 Watts P.E.P. Unity gain 140-170 Mhz; 2.5 db gain 440-470 Mhz; Weight is approx. 1lb.; Color: Black; Impedance: 50 ohms

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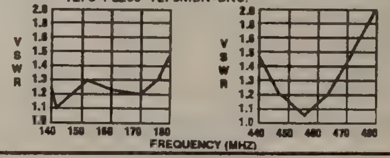

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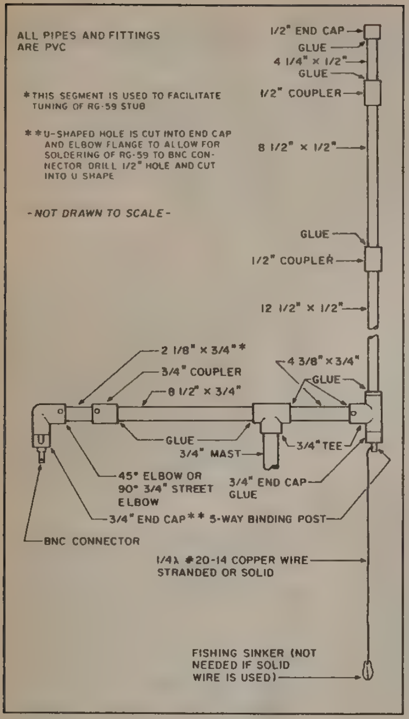
ALL PIPES AND FITTINGS ARE PVC
*THIS SEGMENT IS USED TO FACILITATE TUNING OF RG-59 STUB
**U-SHAPED HOLE IS CUT INTO END CAP AND ELBOW FLANGE TO ALLOW FOR SOLDERING OF RG-59 TO BNC CONNECTOR DRILL 1/2" HOLE AND CUT INTO U SHAPE
-NOT DRAWN TO SCALE-
1/2" END CAP
GLUE
4 1/4" × 1/2"
GLUE
1/2" COUPLER
8 1/2" × 1/2"
GLUE
1/2" COUPLER
12 1/2" × 1/2"
2 1/8" × 3/4"*
3/4" COUPLER
8 1/2" × 3/4"
4 3/8" × 3/4"
GLUE
GLUE
3/4" MAST
3/4" TEE
45° ELBOW OR 90° 3/4" STREET ELBOW
3/4" END CAP GLUE
3/4" END CAP** 5-WAY BINDING POST
BNC CONNECTOR
1/4λ #20-14 COPPER WIRE STRANDED OR SOLID
FISHING SINKER (NOT NEEDED IF SOLID WIRE IS USED)

Figure 1.

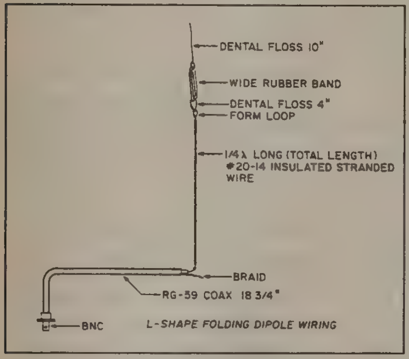
DENTAL FLOSS 10"
WIDE RUBBER BAND
DENTAL FLOSS 4"
FORM LOOP
1/4λ LONG (TOTAL LENGTH) #20-14 INSULATED STRANDED WIRE
BRAID
RG-59 COAX 18 3/4"
BNC
L-SHAPE FOLDING DIPOLE WIRING

Figure 2.

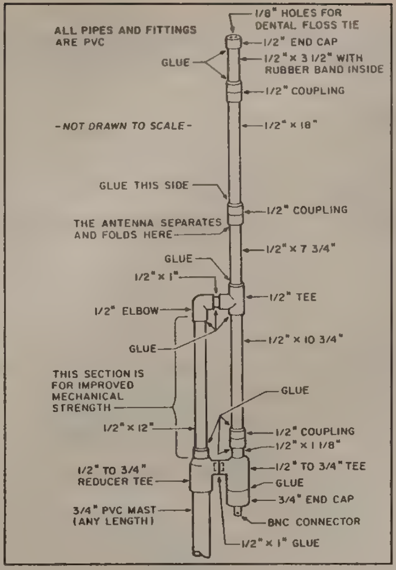

Figure 3.

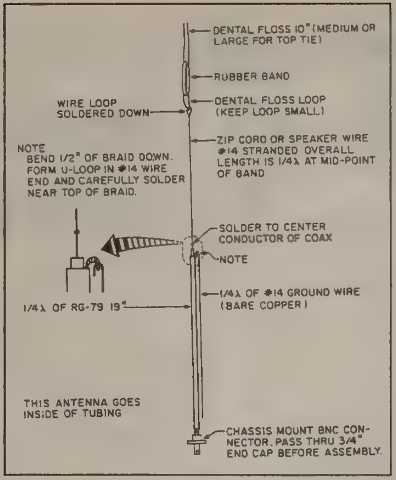
DENTAL FLOSS 10" (MEDIUM OR LARGE FOR TOP TIE)
RUBBER BAND
WIRE LOOP SOLDERED DOWN
DENTAL FLOSS LOOP (KEEP LOOP SMALL.)
ZIP CORD OR SPEAKER WIRE #14 STRANDED OVERALL LENGTH IS 1/4λ AT MID-POINT OF BAND
NOTE
BEND 1/2" OF BRAID DOWN. FORM U-LOOP IN #14 WIRE END AND CAREFULLY SOLDER NEAR TOP OF BRAID.
SOLDER TO CENTER CONDUCTOR OF COAX
NOTE
1/4λ OF RG-79 19"
1/4λ OF #14 GROUND WIRE (BARE COPPER)
THIS ANTENNA GOES INSIDE OF TUBING
CHASSIS MOUNT BNC CONNECTOR. PASS THRU 3/4" END CAP BEFORE ASSEMBLY.

Figure 4.

Parts List

For the "I" antenna (all PVC):

1	1/2" end cap
2	3/4" TEE connectors
1	1/2" elbow
3	1/2" couplers (One 10' section of 1/2" PVC plastic pipe is less cost per foot than a shorter length.)
5'	1/2" water pipe
1	3/4" end cap
1	3/4" water pipe
1	BNC connector
2'	RG-59 coax
4'	#14 speaker wire or zip cord (stranded) container of glue for PVC (3/8 in. self taping screws can be used; 1/4" screws are best #6 size)
1	heavy duty rubber band Medium or thick dental floss

For the "L" antenna:

1	1/2" end cap
2	1/2" couplers
2	3/4" TEEs
1	1/2" to 3/4" reducer
2	3/4" end caps
1	3/4" coupler
1	3/4" street elbow or 45 degree elbow
2'	RG-59 coax
1	BNC connector
1	five-way binding post
4'	Speaker Wire or Zip Cord #14, also #14 solid ground wire rubber band and dental floss

of the cutter to engage. This will ensure accuracy. Glue the parts together as shown, with no changes: This design is what allows the antenna to fold. A rubber band is used in the top of the antenna, along with "wide" dental floss. One good thing about this project is that if you really goof the first time, the materials are inexpensive and easy to work with, so making another won't be too bad. You might want to make this a club project (half-inch PVC comes in 10-foot lengths). Three-quarter-inch PVC is used for the mast, although a wood dowel of suitable diameter could be used.

The "L" Antenna

The "L" antenna is similar to the "I" antenna, only the bottom half of the dipole is a quarter wavelength of wire, dangling from the bottom of the PVC structure. The reason for this is that gravity is used to stretch out the bottom half of the antenna while a structure of some type is needed to hold the top half erect. Tuning is accomplished before final assembly of the antenna. In both antennas, two 1/16" holes are drilled in the end caps to allow for tying of the dental floss.

In both antennas the SWR was no greater than 2.8 to 1, depending on how well it was tuned. Several repeaters were accessed that were not accessable with the HT-mounted antenna. A good thing about these antennas is that they can be mounted several feet away from the operator, radiating more signal into the ether, and not be detuned as much by surrounding objects.

Tuning is accomplished by cutting off *very short* lengths of wire until resonance is reached. On the rubber band side, allow for a loop to be formed for attaching the rubber band. The overall length of the wire, loop included, determines resonance.

Good signal reports were given by the members of the "Michigan, Midnight, Mobilers, and Munchers Net." They were one of the sources of inspiration for this project. The repeater is about 10 miles from my QTH and I tested the antenna in the basement. If you are interested in doing the arithmetic, the following equation will be helpful. The length of each leg of the dipole is:

$$l = \frac{2808}{f\ (\text{MHz})} \quad \text{inches}$$

This equation gives the overall length of one stranded conductor, measured from the center of the antenna. Two wires are required for each antenna.

If you are interested in experimenting with coaxial cable impedance matching stubs, the equation to find the length of a quarter-wave stub is:

$$l = \frac{1948.32}{f\ (\text{MHz})} \quad \text{inches for RG-59}$$

This formula is good for RG-59. The quarter wavelength in free space is no longer than it is for a section of coaxial cable. (This information is on page 87 of the *ARRL Antenna Book*, copyright 1960.)

A suitable mast can be almost anything. I tried a microphone stand and it worked. A flange could be fastened to a piece of 1/2" plywood, about 20 inches square. In that case a length of 3/4" PVC could be used. Guying, of course, would be required. My guestimate would be to keep the height to about a maximum of eight feet or so. Guy ropes can be made of nylon cord, available at any hardware store. If the hanging wire part of the "L" antenna isn't too straight, a fishing sinker can be attached to it, or #14 solid ground wire can be used.

This is a fun project that gives a significant improvement to the overall effectiveness of operation of an HT on 2 meters. I hope you have an enjoyable time building and using it. RF

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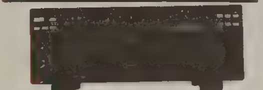

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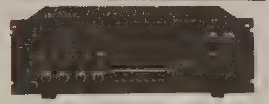

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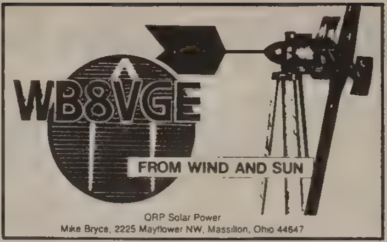
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radio magic

by Michael Bryce WB8VGE

Test Gear

Just to keep your equipment running up to par, and to do some troubleshooting on your home-brew rigs, you'll need some test gear. As I mentioned in an earlier column, a digital VOM (volt-ohm meter) will come in very handy, but there are times when you'll need a bit more. This month we'll look at some test equipment you can build yourself.

I don't have a fully equipped test bench—most hams don't. What I do have is simple, easy to use, and best of all, didn't cost me the farm. Radio Shack can provide a lot of test gear, all at a reasonable price, and all of good quality. You'll also find some good deals on test gear from several advertisers here in *Radio Fun*. Let's look at some of the things you'll need.

The digital VOM is first on my list. The digital autoranging VOM makes troubleshooting much easier. Along with the digital VOM, you'll also need another VOM, but this time make it an analog type. You just can't beat looking at a swinging needle when peaking up an IF (Intermediate Frequency) stage in a receiver. The newer digital VOMs have a moving bar display to allow you to see the "swing" of a meter's needle. I still prefer the moving meter to peak and tweak circuits.

Most of the smaller analog meters have an input sensitivity of around 20k ohms. This means the meter will "look" like a 20k resistor when placed across the circuit being tested. For 80% of the time this is fine, but what you really should have is a high impedance analog meter. By high impedance, I'm talking of at least 10 megohms input sensitivity. The older VTVMs (Vacuum Tube Volt Meters) have input impedances of 10 megohms. Heathkit's IM 5228 is a classic example of a VTVM. Heath no longer makes test gear, but you may find the IM5228 at many hamfests and swapmeets. Expect to pay anywhere from $20 to $70 for one. The IM 5228 uses one tube (and thus the reason for the name, Vacuum Tube Volt Meter) so it would not be a bad idea to pick up a new tube while walking through the hamfest. Check the manual to determine what tube you'll need. The IM 5228 will measure both AC and DC voltages and resistance, but not current. Several different companies also made VTVMs, so check around.

A newer version of the VTVM may be purchased at Radio Shack. It's their Micronta Model 22-220 and it has an input impedance of 10 megohms. Instead of a tube, the 22-220 uses a pair of FET transistors. Besides measuring both AC and DC voltages and doing resistance checks, the 22-220 will also read DC current, from 100 micro amps to 10 amps.

I especially enjoy the built-in continuity checker. This feature allows for eyes-off checking of continuity by just listening for a beep tone instead of watching a needle on the meter's face. The best part of the 22-220 is the price: around $40. I've seen it on sale for about $29.

By the way, most digital meters have an input impedance of over 10 megohms. Newer models have built-in continuity beepers, too.

Build an RF Probe

Now that you have a good meter or two, here is a really simple probe you can make to check for RF. It's called an RF probe. An RF probe consists of a capacitor to couple a very small amount of RF from the circuit you're testing to a germanium diode. The diode rectifies the RF to a DC level. This DC level is then read by the voltmeter. In this case, you'll need the high input impedance of the VTVM or the FET Micronta meter from Radio Shack. Lower input meters will load down the RF probe, giving a false reading.

This circuit can be built into almost any holder. I've used old ball-point pens with good luck. But remember, when working near high voltage sections, use material which will hold up under these voltages!

If you can find one, an old cigar holder works well (plastic . . . *not* metal). A large discarded marker pen works well, too. Assemble the circuit into the holder using a scrap piece of perfboard. Use a small piece of heavy copper wire for the probe's tip. A cork or other insulator will work to hold the tip in place. From the other end you'll send two wires, one for the ground return and the other to the VTVM.

A case made of double-sided PC board works well for holding the RF probe.

You'll need a 0.001 µf capacitor. Unless you plan on using the RF probe for solid-state testing only, use a voltage capacitor rated at least 100 volts DC.

If you plan to use the probe on tube gear, then make sure the 0.001 µf capacitor has a 600 VDC rating or higher. Check out Mouser Electronics or other larger electronic supply houses for high voltage capacitors—surplus houses are great sources for them.

The diode is a 1N34A germanium type. I picked up a package of 10 diodes at Radio Shack for 99 cents. Don't substitute a 1N914 or other silicon diode for the 1N34A. The 1N914 will work, but the higher voltage drop will cause the meter to suffer in low level RF work.

Using the RF probe is simplicity itself. Connect up all the ground leads: one from the RF probe to the chassis ground of the equipment you're working on, the other to the VTVM. Now, with the RF probe's tip, touch it to the point you're testing for RF. Since the capacitor will block all DC voltages, all the diode will see is RF. If there is RF at the test point, the diode will rectify it and the VTVM will display the result on the DC voltage scale.

Because our RF probe is not calibrated against any reference, what you see may not be what the manufacturer shows in the schematic. The idea is to be able to see the RF and then tell if you have none, a small amount or bunches of RF at the test point.

Other Useful Equipment

Another piece of test equipment you'll find very handy is a small audio amplifier. Again, Radio Shack has just such a device for under $12. It's battery powered and completely portable. It's great for testing direct conversion receivers such as the Heath HW-7 or HW-8. As you recall, I used a pair of high impedance headphones to detect audio on the broadcast receiver I was working on. This small amplifier would have worked better, and would probably have been a lot safer to use, too.

When coupling a signal into the amplifier, you'll need to use a blocking capacitor. This will keep any DC voltages riding on the audio circuits from cooking the amplifier. Use the guide lines above for picking a working voltage for this capacitor.

Well, that's all for this month. Next time we meet, I'll continue our look at inexpensive test gear. **RF**

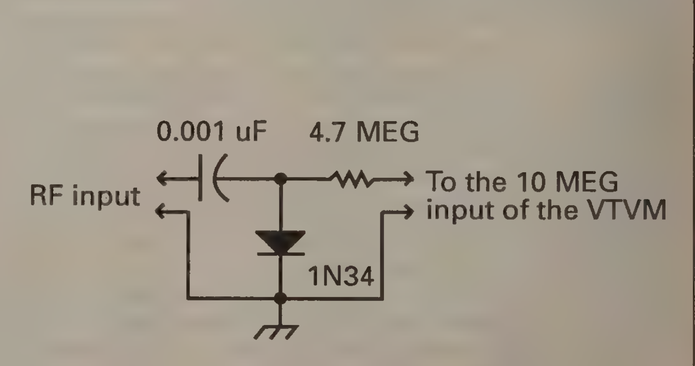

Figure.

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Using Thin-Wire Antennas

by John J. Schultz W3EEY

Many amateurs who live in apartment houses, or even in private homes, are faced with a situation in which a conspicuous outside antenna cannot be erected. One solution to this problem is to use an indoor antenna and accept the signal loss caused by absorption due to the building structure. Such antennas can be reasonably useful depending upon specific circumstances—height, building construction, etc. They also can cause tremendous problems, such as coupling RF into power lines and other wiring circuits. Working on the basis that almost any antenna placed outdoors will work better than one indoors, we're faced with the problem of constructing a reasonably inconspicuous antenna. No antenna can be completely inconspicuous to someone who knows what to look for, but at least the average person will regard any piece of wire that is visually inconspicuous as being inconsequential both from an aesthetic and interference viewpoint. Many approaches may be tried to produce an inconspicuous antenna, but probably the simplest and least expensive uses extremely thin wire in lieu of conventional large antenna wire.

This article explores various considerations that one should observe when constructing a thin-wire antenna in order to obtain the most efficient performance. (What constitutes "thin-wire" or a reasonably inconspicuous size depends upon specific circumstances, but generally a wire size of AWG #18 or smaller is meant.)

Antenna Type and Placement

As will be explained more fully later, thin-wire antennas, because of their very nature, can develop very high voltage points with only moderate transmitter power. Therefore, one of the great problems that may develop with such antennas is RF in the shack when a single wire type is used with a ground connection to a plumbing or heating system. An unbalanced antenna should be avoided if at all possible and some form of balanced antenna used—a dipole V—even if it means that each leg of the antenna will be shorter than that obtainable with a single long wire. A transmission line should also be avoided if possible, and both legs of the antenna coupled directly to the terminals of an antenna coupler located near a window or on a balcony. If a transmission line is used because a considerable height advantage can be achieved by remote location of the antenna, one is faced with the conflict that the less conspicuous the transmission line, the greater its attenuation. A generally acceptable compromise is to use 72 ohm receiving twin lead, which is relatively small and has acceptable losses if runs of 50 feet or less are used. Another possibility for a really small coaxial transmission line is RG174 A/U, which is a 50 ohm cable only 1/10" in diameter. Again, its losses are tolerable only in runs of about 50 feet and its power handling capability is no more than 50 watts.

The placement of the antenna should avoid coupling to surrounding lossy surfaces. The worst condition probably exists when an antenna is run close to and parallel to a building surface. Ideally, the antenna should be placed at right angles to the building surface, or if parallel to it, at least as far away as is consistent with keeping the installation inconspicuous. There is certainly more art than science involved in the placement of such antennas in a complex building structure, but the above two rules seem to consistently apply.

Antenna directivity is another factor which defies any exact rule-making. Normal dipole radiation is at right angles to the line of the antenna. But, when the antenna is extremely close to a ground surface, considerable low-angle radiation in line with the antenna may occur.

Another problem is in determining what the ground surface is for an antenna. When it is mounted away from a building wall of considerable area in terms of wavelengths, the building wall may form the ground surface for the antenna, rather than the earth surface. For instance, in Figure 1, if one considered the earth surface as the ground surface, radiation should be expected in the direction shown by the arrow. However, the building surface may well act as the ground surface and one may simply be radiating most of the signal straight up and down. The solution, of course, would be to rotate the line of the antenna by 90 degrees so that the radiation is bi-directional with the building surface acting as the ground surface. This rather simple re-orientation of an antenna can produce a very dramatic improvement in performance in many apartment situations.

Antenna Impedance and Coupling Methods

Figure 2 shows the resistive and reactive terminal values of a dipole antenna as its length varies between essentially 0 and 1-1/2 wavelengths long overall. The curves are shown for an antenna having a wire diameter of frequency divided by 100,000, or about AWG #26 wire used on 40 meters—which certainly qualifies as a thin-wire antenna. With slight modification, the resistive and reactive values repeat as the antenna is made longer in terms of wavelength.

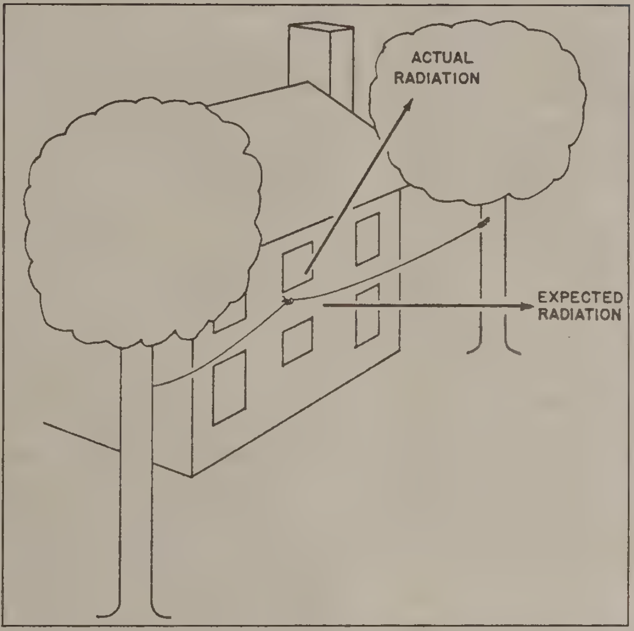

Figure 1. As explained in the text, depending upon which ground surface has the major effect, the radiation from the antenna may not be as shown but actually up and down. Reorientation of the antenna may produce considerably more effective radiation.

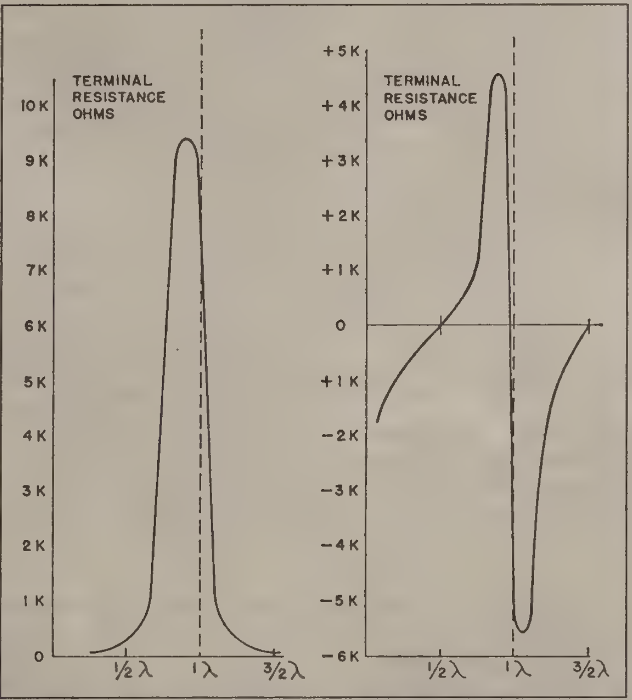

Figure 2. Free-space resistance and reactance values for a dipole having a wire diameter of frequency divided by 100,000 (approximately AWG #26 wire used on 40 meters). Of interest is the fact that when the dipole is an even multiple of a wavelength long (physically), resonance as defined by zero reactance actually occurs at a slightly shorter length. The curves basically repeat for longer length antennas except that the peak amplitudes slowly decrease.

The values shown are based on a dipole in free space and although it is not desired to make a complex subject even more involved, it should be realized that proximity to a ground surface will modify the values shown, particularly the resistive component. The reactance of a 1/2-wave dipole in open space, as read from the graphs, would be zero, and the resistance about 70 ohms. As the antenna is placed nearer a ground surface, however, particularly below 1/10-wave distance, the resistance decreases rapidly and can easily be only a few ohms, as for a 40 meter dipole placed a foot above a ground surface. This is one of the reasons why the use of a transmission line to feed a remotely located dipole is generally not recommended unless the height advantage gained is very considerable. Without appropriate instrumentation, it is difficult to determine the input impedance of a dipole remotely located close to a building surface and one will likely end up with a transmission line operating at a very high SWR.

It should also be noted from

Continued on page 27.

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End-Fed Copper Dipole

Why buy when you can build?

by Mike Gray N8KDD

Photo A. The completed antenna.

I needed a good 2 meter antenna which would be suitable for both stationary mounting and remote-site use. I could have purchased an antenna which would meet the requirements, but that wouldn't satisfy the burning desire to build something, and I can build eight antennas for the price of one commercial vertical.

This project is easily constructed from parts found in any plumbing supply store. It can be tuned to any frequency, but the overall distance from the lower coupler to the top of the upper element should be less than 40 inches. Wind may cause problems with a longer antenna.

See the "Components List" for this project. Most of us have some scrap plumbing in the garage. The pieces are too short to use but too good to throw away. Drag it out—you saved it for a project just like this! You will also need a propane torch, a tube cutter, and a bottle of PVC pipe cement.

Tubes

Start by cutting two copper tubes to the proper length for the frequency at which you intend to operate. Make them a little longer if you like, and shorten them during the tuning phase.

1/4-wave element (inches) =
2808/frequency (MHz)

File the inevitable burrs from both ends of each tube and polish them bright with sandpaper. While you have the sandpaper in hand, polish the inside of one end of each tube to prepare it for solder.

Heating the outside of the copper tube with a torch, tin the inside of one end of each copper tube with rosin-core solder. Cut the PVC pipe to length. Make it a minimum 12 inches, but not longer than 30 inches. If the PVC pipe is much longer the force imparted to the lower coupler during a wind storm may be more than the coupler can take.

Cement a coupler to one end of the PVC tube, and slide one of the copper tubes into the coupler. Don't cement the copper tube to the coupler yet.

Cable

Feed the coaxial cable through the PVC pipe, and through the copper pipe. The cable should come through the tinned end of the copper pipe.

Strip 3/4-inch of jacket from the cable. Separate the braid from the center dielectric, then twist it together to form a conductor equal in length to the center conductor. Tin the center conductor and the twisted braid no more than 1/4-inch from the end. (The braid needs to remain flexible for this to work.)

Bend the braid into a "J" shape and solder it to the inside of the tinned end of the copper tube. Heat the outside of the tube—don't burn the cable.

Once the braid is soldered to the lower tube, pull the coax through the tube as far as the braid will allow it to go. Slide a coupler over the coax and onto the copper tube. Solder the center conductor to the inside of the upper tube in the same way that you soldered the braid to the lower tube.

Slide the upper element into the coupler and seat it gently. If it won't slide all the way in, polish the copper tube sandpaper.

Measure the resistance between the upper and lower elements. If the meter indicates that the elements are connected electrically, pull the assembly apart and track down the short. Do not attempt to tune the antenna unless the meter indicates infinite resistance between the copper elements.

Tuning

You originally cut the copper to approximate lengths. Now you need to cut them to resonate at the frequency you intend to use most often.

Clamp the PVC tube to a suitable support, keeping the copper as far as possible from any objects which might reflect. Measure the SWR above and below the target frequency.

Using a tube cutter, remove about 1/4-inch from the top element, then check the SWR. More copper will prob-

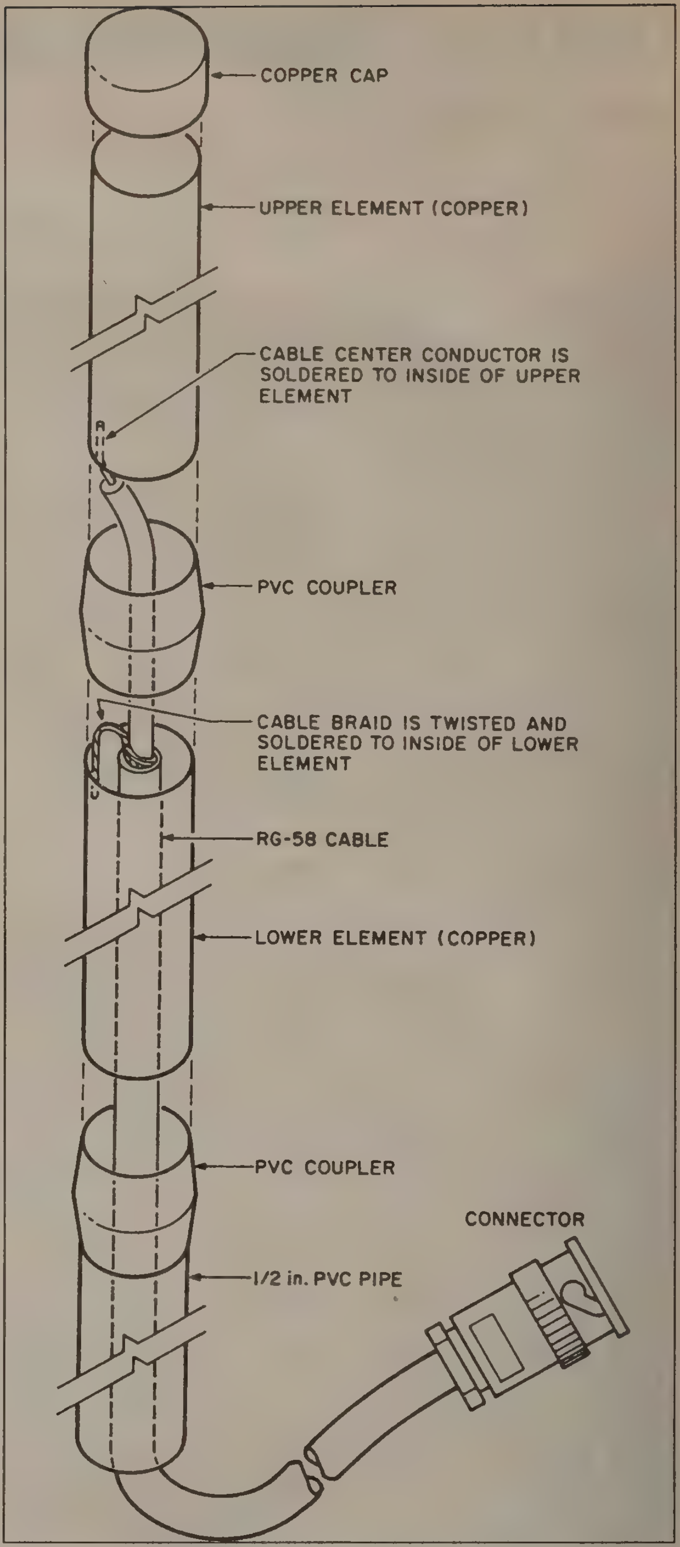
COPPER CAP
UPPER ELEMENT (COPPER)
CABLE CENTER CONDUCTOR IS SOLDERED TO INSIDE OF UPPER ELEMENT
A
PVC COUPLER
CABLE BRAID IS TWISTED AND SOLDERED TO INSIDE OF LOWER ELEMENT
RG-58 CABLE
LOWER ELEMENT (COPPER)
PVC COUPLER
CONNECTOR
1/2 in. PVC PIPE

Figure 1. The end-fed dipole.

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Components

2	quarter-wavelengths of 1/2-inch hard-copper pipe 146 MHz: 19.23 inches 222 MHz: 12.65 inches 440 MHz: 6.38 inches
2	PVC couplers (the type used to join pipe end-to-end)
1	1/2-inch PVC pipe, at least 12 inches long

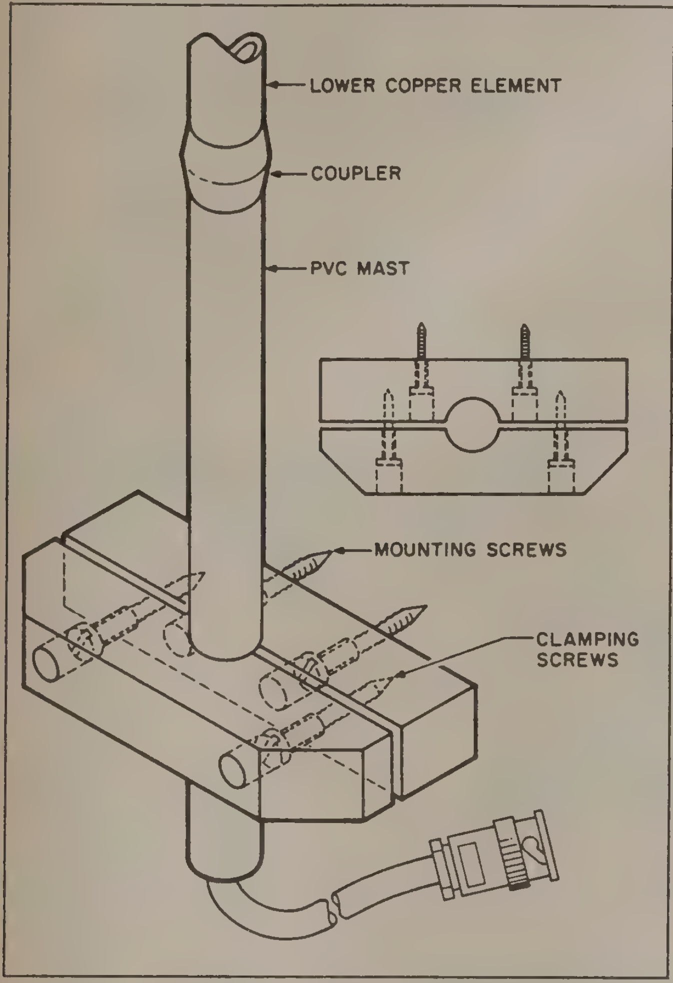

Figure 2. Detail of the clamp.

ably have to be removed. If so, it should be removed from the lower element this time.

Gently pull the lower tube from the coupler and cut the same amount from the lower tube that you removed from the upper tube. If there is a connector on the feedline, the waste copper ring will not slide off, so cut the ring of copper with a pair of diagonal cutters. Reassemble the antenna and check the SWR. Repeat this process as many times as necessary to obtain the lowest SWR. If you are working inside a building you may not get lower than 1.5:1 until the antenna is mounted outside.

If you cut too much copper from the antenna (this almost always happens) install the copper pipe cap on the upper element. The cap will fit tightly, and can be adjusted vertically for the lowest SWR.

Pretty Work

Once the antenna is working properly, solder the copper cap to the upper element. Pull the copper tubes apart and apply a liberal amount of cement to the couplers. Reassemble the components, making sure the tubes are seated just as they were during tuning.

Place the assembly on a flat surface and roll it to reveal any misalignment. If is isn't straight, bend it gently until it rolls smoothly, then allow the cement to dry for at least four hours. Fill the bottom tube with caulk or similar material to relieve strain on the coax and keep the spiders out of your new project. When the cement has dried, install a BNC or PL259 connector on the coax (if it has not already been done). Sand the antenna lightly and paint it with enamel. Paint is necessary because the copper will corrode in time without protection.

Mounting

You probably won't be able to convince the spouse to hold your new antenna at arms length while you engage in a long conversation, so you will need to mount it somehow. The PVC pipe can be clamped to an upright member of nearly any material without affecting the performance, but keep metal objects at least eight inches from the elements.

I built a clamp for my antenna from a piece of scrap two-by-four. The clamp is screwed to a fascia board on the backside of the house. To make this clamp, cut a piece of two-by-four about five inches long (length isn't critical). Bore a 5/8-inch diameter hole through the middle with a paddle bit. Cut the board through the center line of the 5/8-inch hole. Drill and countersink two screw holes in each piece of wood to fit your installation. Make sure that the holes are offset because two of them hold the fixture and two hold the clamp. (See Figure 2.)

Holy Toledo! It Works!

You will notice an improvement in performance over a quarter-wave ground plane antenna while transmitting, and a huge improvement in reception. The reason for better reception may be due to the greater "capture area" afforded by the tubing.

Build a few more of these. The second one takes much less time than the first. RF

letters

Continued from page 5

Well, last month I met a real live ham in the form of another CF driver. He transferred into our barn from up in Oregon. He's been running his 2 meter rig in his truck for over a year and says there's quite a few drivers who do. This is what I needed to hear! He has a Tech-plus license, and also takes his 10 meter rig along sometimes as well. Now I'm hot and heavy into the studying, and my new friend is giving me the kind of encouragement that I needed but was unable to get from these local guys I met on various BBS's. I fully intend to get the no-code Tech first, and once the "stress" of studying for that (and passing it) is behind me, then I can concentrate on learning the code.

There was a small hamfest near here in Gardnerville, Nevada, a while back, but as luck would have it, I was on the road the day it took place and was unable to meet any local hams. I *know* there are some positive people out there. I just have a tough time finding the time to meet them.

My Bearcat HT scanner picks up several of the ham bands, and after picking up a copy of the *ARRL Repeater Directory*, I punched in all the local 2 meter repeater frequencies. I listen in whenever I get a chance. I take the scanner *and* the directory with me on the road, and wherever I lay over, I punch in the local repeater frequencies and check them out. I'm trying to get prepared for the day when I can actually join in.

I'm hoping that the image that most people have of truck drivers doesn't hamper my ability to make friends in these various cities and towns that I frequent with regularity. While my CB is still the best way to get in touch with other truckers on the road, I want to meet hams in as many places as I can.

I've been a subscriber to *Radio Fun* since it came out, and I irregularly pick up *73 Amateur Radio Today*, depending on my interest level (which I think has finally been cemented by the arrival of CFs first ham, in Reno, anyway). If we don't see each other on the job, he calls me every few days to see how I'm doing with the studying.

I especially liked Wayne Green W2NSD/1's column in the March issue of *73*. He said the amateur service has to find some new goals and purposes, or else . . . After he mentioned why, I had to agree 100%. He'd be hard pressed to get agreement from some long-time license holders, however. I think some of them would rather take the hobby to their grave with them, since it's "gone to hell" anyway, what with no-code licenses and all. Why, everyone knows that CW is still the best method of communications under adverse conditions. Wasn't it in one of your publications that I read that the last CW operators shipboard had finally given it up to RTTY type communications? I was a communications technician in the navy 25 years ago, and everything was teletype *then*. Probably the only people who keep the CW going will be ham operators and—terrorists? I still want to learn the code, but only to say I did. Plus, who knows, I might find it fun to communicate around the world using it. I don't want to knock it totally, but the world is going to desktop publishing, cellular phones, home video production, notebook computers, etc., while we fight over the Morse code, like arguing about deck chairs as the Titanic sinks.

So, I'm going to stick it out this time, thanks to another trucker ham. Not all truckers are gross and disgusting, and I will try to interest others who think like I do and are willing to put in the time to study for the exam(s). I write a newsletter for our "barn," and I might bring up the topic in the next issue.

Tom, don't let the turkeys get you down! You are the future of ham radio, not them.
Welcome. . . . David N1GPH

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World Ham Net Directory
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Lists over 900 special interest ham nets. Tune in or work stamp collectors, airline people, missionaries, DXers, rag chewers, dozens more. Listed by interest, frequency, meeting time.
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We'll print as many as space allows, on a "first come-first listed" basis.

JUN 1992

NEWMARKET, ONT., CANADA The York Region ARC is sponsoring the YRARC National "Young Amateur of the Year" Award to help promote the hobby of amateur radio among the youth of Canada. The prize offered to the winner of this award is $500. First and second runners-up will receive $200 and $100 respectively. Submissions for the award will be welcomed from any official of an affiliated CARF or CRRL Club throughout Canada. Details of the candidate, his or her age and accomplishments in the field of ham radio, are the basis for the judging. Candidates must hold a Canadian amateur radio license and be a Canadian resident. Good quality photographs of the candidate will be a definite advantage. Submissions, including details of the sponsor and sponsoring club, should be forwarded before Aug. 31, 1992 to ***Attn: Awards Committee, The York Region Amateur Radio Club, PO Box 352, Newmarket, Ont., L3Y 4X7, Canada.*** The awards will be presented in November at the York Region ARC Hamfest. For more info, call Mr. Andrew Betterton VE3ORE, (416) 895-8710. All awards are made at the discretion of the YRARC.

DICKINSON, ND The Theodore Roosevelt ARC will sponsor a "North Dakota Worked All Counties" certificate, beginning immediately. The certificate is available to Ham and SWL enthusiasts. At this time there is no date set for discontinuation. For an application form, send a #10 SASE to ***Steve Allar N0ELA, 1701 6th Ave. NE, Beulah ND 58523.***

JUN 6

ALAMOGORDO, NM The Alamogordo ARC will sponsor VE test sessions at 12 noon. Persons already holding an amateur license and wishing to upgrade must bring their original license and CSCE (if any), and a copy of both. Talk-in on 146.80, down 600. For info, contact ***Ole WA5IPS, (505) 437-5896; or Larry WA5UNO, (505) 437-0145.***

SOUTH BURLINGTON, VT The Radio Amateurs of Northern VT will sponsor the Northern Vermont Summer Hamfest and Computer Technology Fair from 8 AM-3 PM at the South Burlington Middle School Complex, Dorset St., off of I-89 exit 14-E. Indoor/outdoor Flea Markets. Close proximity to shopping malls. VE Exams will be given at 2 PM. Admission $3, free for under 18 years. No charge for flea market spaces. Tables available. Talk-in on 146.25/.85. Hamfest contact: ***N1DMP, (802) 893-6458.*** Exams contact: ***WB2JSJ, (802) 879-6589.***

JUN 7

PRINCETON, IL The Starved Rock RC Hamfest will be held at the Bureau County Fairgrounds, starting at 6 AM. Advance tickets $4 (before May 20th) and $5 at the gate. Free camping and outdoor Flea Market area. 8' tables indoors are $10 ea. Talk-in on 146.355/.955. Contact ***Bruce Burton KU9A or Debbie Burton N9DRU, 1153 Union St., Marseilles IL 61341-1710. Tel. (815) 795-2201.***

JUN 8

BOULDER, CO The Boulder VE Team will conduct VE Exams at St. Mary Magdalene Episcopal Church, Heatherwood Dr. and Cambridge St., starting at 7 PM. Contact ***Barbara McClune N0BWS, (303) 530-2903.*** Pre-registration preferred; walk-ins welcome. Please bring a picture ID and one other ID; check or money order for $5.40, payable to ***ARRL-VEC***; the original and one copy of your current license (if any); the originals of applicable Certificates of Successful Completion of an examination, if you claim credit for any test elements; a copy of the FCC 610 you submitted, if you claim credit for a Novice license not yet received; soft pencils and a calculator.

JUN 12

ELLENVILLE, NY The Chaverim 6th Int'l Convention, sponsored by an assn. of Jewish amateurs and their friends, will be held at the Fallsview Hotel. For details, contact ***Arnold L. Halpern W2GDS, 450 Brighton Ave., Long Branch NJ 07740. Tel. (908) 222-3009.***

JUN 13

WINSTON-SALEM, NC The Forsyth ARC will sponsor the Winston-Salem Hamfest/Computer Fair from 9 AM-5 PM at the Benton Convention Center, downtown. Flea Market. VE Exams (pre-register). Admission $5 in advance, $6 at the door. SASE to ***Henry Heidtmann, Winston-Salem Hamfest, PO Box 11361, Winston-Salem, NC 27116. Tel. (919) 785-3900 (9 AM-10PM).***

MARMORA, ONT., CANADA The Eastern Ontario Hamfest, sponsored by the Marmora ARC, will be held at Marmora Area Curling Club starting at 9 AM. Admission $3. Tables $5. Tailgate $2. Talk-in on VE3TZW 146.655/.055 rptr. Contact ***George Foster VE3NKJ, (613) 472-5948.***

LOVELAND, CO The Northern Colorado ARC will present Superfest IX at the Larimer County Fairgrounds, 700 S. Railroad, beginning at 8 AM. Set-up Fri. eve. Jun. 12, or at 6AM Sat. Free parking. ARRL VEC Exams. Camper hookups. Admission $3. Tables $7 ea. (for reservations contact ***Bill Morrison NK0MA, 1743 Eastwood Ct., Ft. Collins CO 80525. Tel. (303) 224-5305***). For info, contact ***John Schmidt NK0R, 1001 King Dr., Loveland CO 80537. Tel. (303) 663-7581.***

BANGOR, ME The Pine State ARC will sponsor the Bangor Hamfest/Computerfest at the Hermon Elementary School. Take US #2 to Hermon Corner (at the monument) take the Billings Rd. for 2 miles to the school. Follow the signs. Free parking. Flea Market. VE Exams, all classes. CW contest. There are 3 campgrounds and many motels within 5 miles of the Hamfest. Contact ***Roger W. Dole KA1TKS, RR #2 Box 730, Bangor ME 04401. Tel. (207) 848-3846.***

HUNTINGTON, WV The Tri-State ARA, Inc., will offer VE Exams at Our Lady of Fatima church school classrooms, located at 545 Norway Ave., Huntington WV, at 10 AM. No pre-registration necessary. Arrange to arrive by 9:15 AM to register. Have ID and Form 610 checked prior to the exam. For more info, call ***Jim Baker K8KVX, (304) 736-6542.***

JUN 14

HUMBOLDT, TN The Humbolt ARC Hamfest will be held at the Humboldt High School Cafeteria, 2600 Viking Dr., from 8 AM-4 PM. Admission $5. Tables $5. Contact ***Ed Holmes W4IGW, 501 N. 18th Ave., Humboldt TN 38343. Tel. (901) 784-3490.***

STEVENS POINT, WI The Central Wisconsin Radio Amateurs, Ltd. (CWRA), will hold its 15th annual SWAPFEST at the University Center on the U. of Wisconsin-Stevens Point campus. Free parking. Wheelchair accessible. ARRL VE Exams. Tables and electrical power will be available for commercial vendors. For info and registration, contact ***Art Wysocki N9BCA, CWRA Swapfest Chairman, 3356 April Lane, Stevens Point WI 54481. Tel. (715) 344-2984.***

WINFIELD/CENTRAL, PA The SVARC and Milton ARC will co-sponsor a Hamfest at the Winfield Fireman's Grounds (60 miles North of Harrisburg, on US Route 15). VE Exams by pre-registration. Admission $4. Outside table/tail-gate space at $1/6'. Contact ***SVARC, Inc., Box 73, Hummels Wharf PA 17831. Tel. (717) 473-7050. Packet KD3KR @ NR3U.PA.***

LANCASTER, NY The Lancaster ARC will hold their Hamfest at the Elks Club Hall, Rt. 20-Broadway in downtown Lancaster, across from the post office. Large parking lot for outdoor Flea Market and general Hamfest parking. Admission $4 in advance till May 1, or $5 at the door (includes 8' outdoor flea market space). Vendors, contact ***Nick WA2CJJ, 5645 Genesse St., Lancaster NY 14086. Tel. (716) 681-6410;*** or ***George Ebert N2NOB, 1330 Bailey, Buffalo NY 14206. Tel. (716) 894-0343.*** Talk-in on 146.550 simplex or 224.640 rptr.

WILLOW SPRINGS, IL The 35th annual Hamfest, sponsored by the Six Meter Club of Chicago, Inc., will be held at Santa Fe Park, 91st St. & Wolf Rd., Willow Springs IL. Advance tickets $4, $5 at the gate. Large swapper's row. Free parking. Get advance tickets from ***Mike Corbett K9ENZ, 606 South Fenton Ave., Romeoville IL 60441,*** or any club member. No overnight camping. Gates open at 6 AM. Talk-in on 146.52 K9ONA/R 37-97.

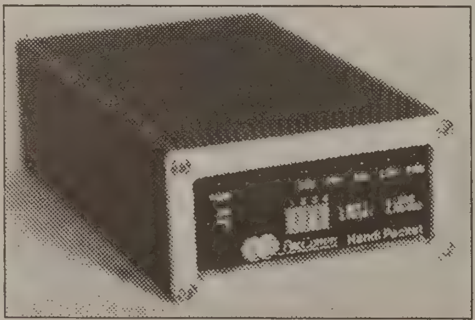
COVINGTON, KY The Northern Kentucky ARC announces "HAM-O-RAMA 92" to be held at the Erlanger Kentucky Lions Park beginning at 8 AM. Set-up at 6 AM. Indoor exhibit area for major vendors. Outside Flea Market. Admission is $5 ($4 in advance) with children under age 13 free. Flea market spaces are $2. Bring your own tables. Indoor vendor space $15 per table (provided). For info and registration, contact ***KC4FET c/o NKARC, PO Box 1062, Covington KY 41012. Tel. (606) 341-1213.*** Talk-in on 147.855+ or 147.375+ rptrs.

GRANITE CITY, IL The Egyptian RC will conduct its annual EGYPTIANFEST at the club grounds on Chouteau Place Rd., Granite City IL., from 6 AM-2 PM. Overnight camping Sat. VE Exams will be conducted at the Sanford Brown Business College, 3237 W. Chain of Rocks Rd. Pre-registration is requested, but not required. The class is limited to 60. Contact ***Eric Koch NF0Q, (314) 946-0948*** to pre-register. Advance tickets $1 or 6/$5; $2 or 3/$5 at the fest. Contact ***Jim Cleland K9RKU, PO Box 562, Granite City IL 62040,*** or call ***(618) 344-2401*** for info or tickets.

AKRON, OH The Goodyear ARC's 25th annual Hamfest/Family Picnic will be held at Wingfoot Lake Park near Akron OH, from 8 AM-4 PM. Family admission is $4 in advance, $5 at the gate. The outside Flea Market will be $3 per space. Inside dealer area $6 per table (advance reservations suggested). No overnight parking. No pets, no swimming please. For advance tickets and info, contact ***William F. Dunn W8IFM, 4730 Nottingham Lane, Stow OH 44224. Tel. (216) 673-8502.***

JUN 19-21

BURBANK, ALBERTA, CANADA The Central Alberta Radio League will sponsor their 21st annual Picnic at the Burbank Campground, located at the confluence of the Blindman and Red Deer River valleys. Registration starts Fri. afternoon. $15 per family unit camping fee. $10 single unit camping fee. $10 weekend private stall. $5 Sat. evening barbecue and dance (at 1800 h). Children under 12, $3. $6 per weekend pass (no camping). Event Station call VE6UK, 147.150+ 0.600 MHz; simplex 146.520. For further info and Golf registration, telephone ***Pat Wight VE6ALD, 346-3013.***



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JUN 20

CYPRESS, CA The Catalina Amateur Repeater Assn. will hold its annual HAMFEST indoors at Cypress College, 9200 Valley View St., Cypress CA (just west of Knott's Berry Farm), from 9 AM-4 PM, in the Math/Science Bldg., near the lake. Admission $10, includes hamburger/chili luncheon. VE Exams. Vendors need to reserve space. Contact ***Jo Ann Taylor KC6NJG, (714) 777-1260,*** or ***FAX (714) 779-7761.***

MIDLAND, MI The 18th annual Hamfest, sponsored by the Central Michigan Amateur Rptr. Assn. (CMARA), will be held at the Community Center in Midland MI from 8 AM-1 PM. Admission $3. Tables $9 each. Talk-in on the Midland 147.60/.00 rptr. VE Exams, walk-ins welcome. Contact ***CMARA Hamfest, PO Box 67, Midland MI 48640.*** Please SASE. Or call ***Joe WD9GUF at (517) 631-8818,*** eves. and weekends.

JUN 20-21

WOLF POINT, MT Prairie Radio Club will host the annual Northeast Montana Hamfest Picnic at Wolf Point MT. Contact ***Jack Greenwood WB7QDN*** for info.

JUN 21

CROWN POINT, IN The Lake County ARC will host their 20th annual Dads' Day Hamfest at the Lake County Fairgrounds, beginning at 8 AM. Indoor spaces. Set-up at 6 AM. Admission $4. Tables $6. VE exams. Talk-in on 146.52 simplex and 147.00/.60 rptr. Contact ***Mike Warot KA9DGX, 7751 Chestnut Ave., Hammond IN 46324. Tel. (219) 845-7970.***

MONROE, MI The Monroe County Radio Communications Assn. will sponsor a Hamfest at Monroe County Fairgrounds, M-50 at Raisinville Rd., Monroe MI. Handicap parking. VE Exams. Advance tickets $3, $4 at the gate. Indoor tables $10 per 8' table. Trunk sales $3 per 8' space. Contact ***Fred Lux WD8ITZ, PO Box 982, Monroe MI 48161. Tel. (313) 243-1053 eves.***

CAMBRIDGE, MA The MIT Radio Society and the Harvard Wireless Club will co-host a TAILGATE electronics, computer and amateur radio FLEA MARKET, rain or shine, at Albany & Main St., Cambridge MA from 9 AM-2 PM. Free off-street parking. Admission $2. Sellers $8 per space at the gate, $5 in advance (includes 1 admission). Set-up at 7 AM. For info or reservations, call ***(617) 253-3776.*** Mail reservations before June 5th to ***W1GSL, PO Box 82 MIT BR., Cambridge MA 02139.*** Talk-in 146.52 and 449.725/444.725 pl 2A W1XM rptr.

FREDERICK, MD The Frederick ARC will hold its annual Hamfest on Father's Day at the Frederick County Fairgrounds from 8 AM-4 PM. Admission $4. Tailgaters $5 for each 10' space. Wives and children free with one paid admission. Indoor tables $10. For info, write to ***Frederick Hamfest, PO Box 1260, Frederick MD 21701.***

JUN 28

SOUTH BEND, IN A Hamfest Swap & Shop will be held in PARKING GARAGE Downtown on U.S. 33 ONEWAY North by the Society Bank Bldg. and Century Center, across the street from Winter Hamfest. Free parking nearby. Admission $3. Drive-in selling spaces $5 ea. Talk-in on 52-52, 99-39, 69-09, 34-94, 145.29. Contact ***Wayne Werts K9IXU, 1889 Riverside Dr., South Bend IN 46616,*** or phone ***(219) 233-5307.***

MILFORD, CT At 12 noon, the Coastline ARA will hold VE Exams for all classes at the Fowler Bldg., 145 Bridgeport Ave., Milford CT. Walk-ins welcome. Contact ***Gary NB1M, (203) 933-5125,*** or ***Dick WA1YQE, (203) 874-1014.***

JUL 4

HARRISBURG, PA The Harrisburg RAC will hold a Hamfest at the Bressler Picnic Grounds from 8 AM-2 PM. Set-up at 6 AM. Take Exit #1 off I-283, PA #441 North. Follow signs. Admission $4. Tailgating $6 per space. Tables $10 in advance, $15 at the Hamfest. Call ***Steve Gobat KA3PDQ, (717) 938-6943*** for table reservations.

JUL 11

SUMMERVILLE, SC The Trident ARC will sponsor CHARLESTON II Summer HAMFEST/COMPUTER Expo at the Charleston Southern U. Fieldhouse, I-26 (Exit 205) and US-78 East, from 0800Z-1500Z. Set-up at 0600Z. Wheelchair accessible. Free parking. There will be a True-Auction at 1400 hrs. Advance tickets $6 per family; $5 each at the gate. Tailgate $3. Pre-registered tables $10. Talk-in on 147.27+, 224.64- or 443.80+ Contact ***Chairman, Bubba Johnson N4CII,***

Continued on page 30.

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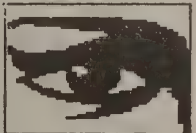
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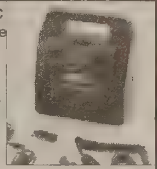

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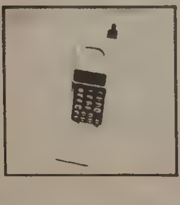

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upgrade don't stop now

by Gordon West WB6NOA

Pick Your Favorite VE Testing Team

When you next take an upgrade examination, you will test in front of three or more registered volunteer examiners. It takes an Advanced class or an Extra class license to be able to sign off a certificate of successful completion (CSCE), and there are thousands of licensed hams who give many hours a week to help *you* take your upgrade examination.

There are 18 United States volunteer-examiner coordinators in the amateur service (see the sidebar). Both the American Radio Relay League VEC and the W5YI VEC offer examinations throughout the country in almost every state, and in most major cities. The other VEC organizations specialize in examinations near their listed address. In other words, if you live in Hawaii, and plan to look for an upcoming exam session, your best bet is to contact the Koolau VEC first. You could also contact the ARRL or W5YI VEC for additional examinations.

Photo A. Test-takers waiting for the code test to begin.

You will find that each VE team has its own little area of operation, and its own way of running a testing team. The majority of VE teams heartily embrace the idea of accelerated growth in amateur radio, especially for the upgrade ranks from no-code.

Word spreads quickly about a testing team that goes out of its way to make the jitters go away from the test-takers. One team I know of has coffee, soft drinks, and donuts for everyone coming into their early morning test sessions. They welcome outside hams to come in and help the applicants fill out their paperwork and feel more at home before going into the actual exam room.

For the written examination, the questions and answers are used verbatim out of the study guides. There is no VE team that has an easier written examination over another team down the street. All the questions and answers are randomly selected from the nationally published question pools.

The Code Test

The code examination, however, is something that varies dramatically from team to team. Some test groups use loudspeakers and an inexpensive boom-box. Others generate their code test on computers, and applicants gather around a table with a central loudspeaker. Some test givers develop their own exotic CW equipment, and allow applicants to bring their own headphones, and adjust a "VFO" for the best pitch. Now that's deluxe!

So it is the CW portion of your examination that may vary between testing groups. Your job is to find out ahead of time what arrangement you like best. After all, it's a real pressure trip taking a CW examination for your upgrade, so why not go with a VE group that has the system that sounds the best to you. After all, your radio receiver for CW has an RIT, notch filter, and IF shift—why shouldn't you at least be able to pick the sound that is most pleasing to your ears?

"If they don't like the sound of our code, they can go pound the asphalt," comments an unnamed volunteer examiner from the Northeast. "The sound of the code, or the duration of the code elements, or the contents of the message sent shouldn't make any difference to an applicant who is well-prepared for his or her code test," comments this same volunteer examiner.

I suppose so—at least, that's the way it was down at the FCC years ago when I took the 13 and 20 wpm tests. This same Northeast group would also require applicants to stop writing just as soon as the CW test has finished its final AR SK. Is this fair? Don't we all go back and plug in some letters here and there after a typical on-the-air QSO? Does the code test require the applicant to stop writing after the last letters are sent? It's up to the individual volunteer examination team. Not the VEC—they pretty much let their teams operate within the general framework of a good CW test—so it's the team that decides exactly what the ground rules are down at the test site.

Some examiners may require one minute of perfect copy. Others may ask applicants to fill in the answers to 10 questions. Some testers may offer multiple-choice answers for some of the questions, and fill-in-the-blanks for others. Studies prove that multiple-choice examinations and fill-in-the-blank examinations have about the same 68 percent pass rate—you would think that multiple choice is a little bit easier, but if you have nothing down on your paper, it won't work. However, if you did relatively well during the CW examination, you can many times plow through your copy and pick out letters here and there that best correspond to a possible multiple-choice answer.

Multiple-choice answers can be easy, or tough. An easy multiple-choice answer to "What type of rig?" would be ICOM, Kenwood, Yaesu, or Alinco. A hard multiple-choice answer scheme might be the sender's occupation—physician, physicist, psychologist, or phsy. ed.

Word gets out about how the volunteer examiners structure their CW tests. You can imagine how many test-takers there were at an exam session that sent the 13 wpm code test at a character (not word) rate of 25 wpm, with big spacing to slow it down to 13 wpm, a low tone of 500 hertz, and a text of 5-letter random groups. The examiners required one minute of solid copy, and I suppose those who really knew their General code passed with flying colors. Those that were a little shaky at 13 wpm bombed out.

It's up to you to begin a dialogue with your local volunteer examination team to see what the CW test ground rules are. Chances are, most teams embrace the idea of plenty of upgrades coming onto our ham bands from their test sessions. These are teams that you might want to go with for your upcoming upgrade exam.

And I'm sure I'm going to get a flurry of letters from those other teams that will denounce the cherry-picking of volunteer examiners, who may embrace the old FCC philosophy of "Make them shake in their boots, and give them a taste of what it was like in the old days."

Why make an examination for a hobby license any more difficult than it already is? "We get a real pleasure watching new hams pass our upgrade examinations," comments Gordon Girton, the VEC for Sunnyvale Amateur Radio Club. "We have very sophisticated code-sending equipment, and any applicant who takes one of our tests usually enjoys the experience, even though he might not have been a successful pass," adds Girton. It's this positive philosophy that most volunteer examination teams throughout the country have. These are the teams you need to shop around for to make you feel at ease when you next go for your upgrade code test experience. RF

U.S. Volunteer Coordinators in the Amateur Service

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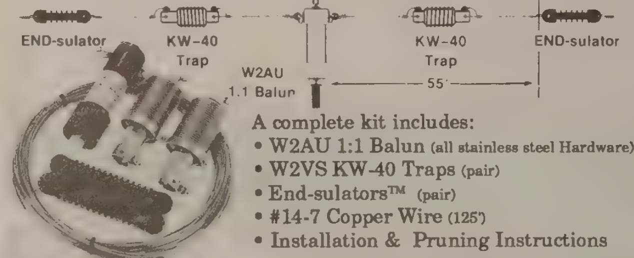

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Continued from page 21

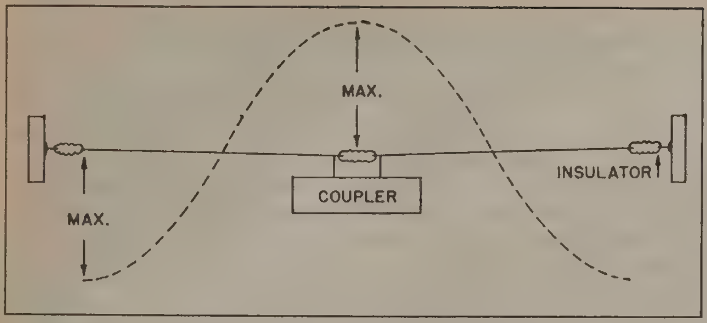

Figure 3. Voltage distribution along a 1/2 wavelength dipole operated on its second harmonic.

Figure 2 that the swings of the resistive and reactive components of the dipole are particularly dramatic when the overall antenna length is an even multiple of a wavelength. Therefore, if one had an antenna which was being used on several bands so that on various bands its length was an even multiple of a wavelength, major readjustments of an antenna coupler might be required for minor frequency excursions within a band in order to resonate the antenna system. Because of this consideration, as well as other factors discussed next, it would be better to choose a length for a multiband antenna so that the terminal impedance remains within reasonable limits on all bands. For instance, if one chooses an antenna length of 3/8- or 5/8-wave on the lowest frequency band to be used, the impedance values on higher frequency harmonically related bands should be well within the range covered by a simple transmatch type antenna coupler. If a basic length of 3/4- or 1/2-wave were chosen, however, it is unlikely that a transmatch coupler could accommodate the impedance range of various harmonic frequencies.

Voltage and Current Considerations

Besides the problem of choosing an antenna length which a conventional tuner can handle, there are also insulation and wire size considerations which affect both the antenna and the tuner. If one operated a basic 1/2-wave antenna on its second harmonic, the terminal impedance would be from 7 to 9k ohms, as shown in Figure 2. With a 100-watt transmitter this would produce over 700 volts of RF, and over 1600 volts of RF with a 300-watt output transmitter. The voltage distribution on such an antenna would be as shown in Figure 3. The voltage peaks occur at the dipole terminals and at the far ends. Thus, the components within the antenna tuner, the feedthrough insulators connecting the antenna to the tuner, and the end insulators all have to be rated for a relatively high voltage if arc-overs (within the tuner) and losses due to long leakage paths are to be avoided.

The consideration that must be given to the effects of current flow can be seen if a 1/2-wave dipole is considered operating on its fundamental (the exact frequency it is cut for) with a terminal impedance of 50-70 ohms. At the terminals, a 100-watt transmitter (CW) will produce about 1.2 amperes. A 300-watt transmitter can produce almost 2.5 amperes. Obviously, very small wire sizes will not handle such currents, although in reality one can get away with using thin wires far beyond their "handbook" current rating because of the intermittent nature of most transmission modes. Nonetheless, AWG #22 wire cannot handle more than 1 to 1.5 amperes and AWG #18 about 2.5 amperes. When one considers really thin wire—down to AWG #30 sizes—the current ratings go down to a few hundred milliamperes.

All the possibilities which involve voltage and current maximums in multiband dipoles can become quite complex. But the above simple examples demonstrate another disadvantage of constructing multiple 1/2-wave antennas of very thin wire. If the antenna is constructed to avoid operation on 1/2-wave multiples, the terminal impedance will not vary over such wide excursions. The voltage and current maximums will be less and both insulation requirements and wire size requirements will be reduced. The reactive component of the dipole impedance produced by such operation can be easily tuned out with a conventional antenna coupler.

Wire Selection

A wide variety of wire types is available for construction of thin-wire antennas. Exactly which type you should use depends upon the specific installation, the length of the antenna, the tension that will be placed on the wire, and how far one wants to go to be inconspicuous while still retaining a wire size adequate to handle the transmitter power. Insulated magnet wire, made of tinned copper, is available in sizes down to AWG #40. One should use the type with a double polyester film coating, but, even then, the smaller sizes will stretch considerably with only slight tension. So-called indoor antenna wire (Belden 8014) is the stranded equivalent of AWG #25, but has considerably better tensile strength. Boinbach high-temperature miniature wire (7524-7534 series) is available in AWG 24-34 sizes and is similar to magnet wire except that it is available with a variety of colored thermoplastic films—in case one really wants to make an effort to have the antenna blend with a background color.

The smallest size in which 40% copper-weld wire is available is AWG #18 (Saxton 5300). It is the best choice if such a size is acceptable. Piano wire is available in smaller sizes, but may corrode in certain environments. Its springiness also can make it difficult to handle. Clear plastic fishing line functions nicely as a combination insulator and tie line for the antenna ends.

Summary

Thin-wire antennas can perform very well when properly installed, and can provide an antenna solution in situations where a conventional installation cannot be used. The considerations involved in using a thin-wire antenna successfully differ somewhat from those when using conventional antenna construction.

A balanced form of antenna should be used, if at all possible, and it should be directly coupled to an antenna tuner. The antenna length should be chosen to avoid impedance extremes on harmonic operation and a high current loop at the tuner terminals on fundamental operation. A tuner should be used which can properly couple to a balanced form of antenna—a transmatch tuner, for instance, and not a pi-network tuner. **RF**

Reprinted from the November 1968 issue of 73 Amateur Radio.

Space Center QSO

Continued from page 1.

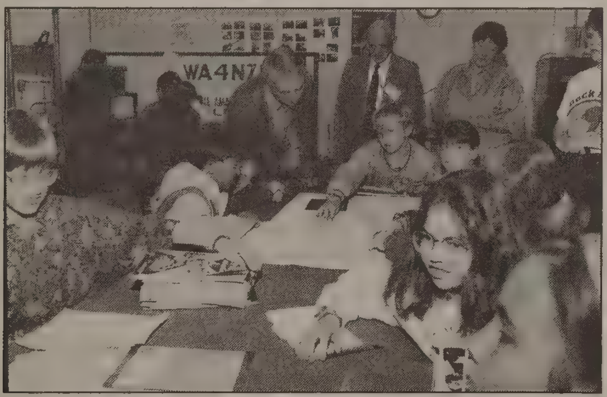

Photo B. Back row (l to r): Former astronaut Owen Garriott W5LFL, Ed Stluka W4QAU and Rory Stratton KD4FJJ consult with Huntsville area students in the WA4NZD Marshall Amateur Radio Club station during the STS-45 mission.

real-time on 2 meters. The post flight behavior of the astro-insects were studied by the students. Each life sciences experiment was compared to a control group.

Every year the Huntsville Schools participate in Space Week. volunteers from local aerospace industries and the Marshall Space Flight Center set up exhibits and visit local schools to talk to students about their jobs. The students study space-related themes and construct their own displays. This past year, an amateur radio satellite station was set up by local AMSAT volunteers to allow the students to talk to hams around the world via the OSCAR 13 satellite.

Huntsville also boasts a very active amateur television (ATV) group (over 40 active stations). The local ATV repeater is used on a regular basis by five ham teachers to interlink their classrooms throughout the city. On weekday mornings students can be seen comparing notes on science experiments or keeping track of the various caged "critters" in their classrooms. The students can also use the repeater's live weather radar link as an adjunct to their study of weather.

Novice Repeater Privileges

On December 31, 1991, Dr. Michael C. Trahos KB4PGC petitioned the FCC to authorize Novice class licensees repeater and repeater control privileges. The FCC assigned RM-7888 to the filing. Comments closed on February 27, 1992.

In his reply comments, Trahos said " . . . no comments were filed in opposition to Petition RM-7888. This includes no officially filed opposition comments by the American Radio Relay League, Inc., the Commission's recognized advocacy organization for amateur radio."

Trahos said his proposal " . . . would definitely further amateur use of the 1.2 GHz and 220 MHz bands." He requests that the Commission move to the NPRM stage.

TNX W5YI Report, Vol. 14, Issue #7, April 1, 1992.

Tapes for the Visually Handicapped

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TRADE: IBM Clone, 286SX Turbo-31 MHz. 1Meg Ram one 5 1/4" 1.2 M-one 5 1/4" 360K disk drives. 33 Meg hard drive, with CGA color monitor, and Stacker, Norton CMDR; MS-DOS 5.0 software. Trade for good H.F. transceiver. N6HDK (209) 772-9221. RF258

SCOPES, SIGNAL GENERATORS AND OTHER TEST EQUIPMENT AND PHOTOGRAPHIC EQUIPMENT. Must clean out 40 year accumulation. S.A.S.E. for complete list to; C. TATE, Box 550, Okay OK 74446. RF259

POWER SUPPLY LAB TYPE with meter. 1.2 to 15V. Buy parts from RADIO SHACK, less than $30. Complete construction INFOPACK. Send $3.00 to LYNN JOHNSON ELECTRONICS, P.O. Box 51268, San Jose CA. 95151-1268. RF262

WANTED; HAM COMPUTER PROGRAMS, shareware or public domain software for IBM compatable. Don Wahle N7URL, Box 1244, Jacksonville OR 97530. RF267

FREE PLANE ANTENNA can be cut from 140Mhz to 1300Mhz. Complete construction INFOPACK. Send $3.00 to LYNN JOHNSON ELECTRONICS, Box 51268, San Jose CA 95151-1268. RF268

MIAMI SCANNER ACTION IS HOT. Hear the cops and more. One call does it all. (305) 460-3374. RF269

PILL BOTTLE ANTENNA TUNER! Only two parts! 80 through 10! Tested-over 150 watts! Complete plans-only $3. DWM ENTERPRISES, 1709 N. West, #103, Jackson MI 49202. RF299

WANTED: Pre-1980 microcomputers for museum collection. KK4WW. 703-231-6478, 703-763-3311. RF552

JUST IMAGINE YOUR OWN 25 TO 50 ACRE cool, green mountaintop QTH in the Blue Ridge Mountains, only $995 per acre. Wild game, great views, ideal for hamming, retirement or summer home. KK4WW, Floyd VA. 703-763-3311. RF553

WANTED: Yaesu FT-23R and Henry 5k or 8k linear amplifier. KK4WW, 703-763-3311/703-231-6478.RF554

SUPER VR85 Amateur Satellite and Space Shuttle Tracking program for Commodore 64. Ideal for beginners and advanced operators. SIMPLY THE BEST C64 TRACKING PROGRAM SINCE 1985. SASE for details. $35.00 ppd (Californians include tax). RLD Research, W6AMW, Box 888, McCloud CA 96057. RF555

LAMBDA AMATEUR RADIO CLUB International amateur radio club for gay and lesbian hams. On-air skeds, monthly newsletter, and annual gathering at Dayton. (215) 978-LARC. P.O. Box 24810, Philadelphia PA 19130. RF812

DIGITAL SWR and **POWER METER,** assembled, kit, or plans, with alarm and set points. **FREE INFORMATION. RUPP ELECTRONICS,** 5403 Westbreeze, Fort Wayne IN 46804. (219) 432-3049. RF816

FREEHam Gospel Tracts, SASE, N3FTT, 5133 Gramercy, Clifton Hts. PA 19018. RF960

ADD DIGITAL FREQUENCY READOUT to your receiver easily and inexpensively. For complete instructions send $5 to Paul Chouinard WB1CTP, PO Box 572, Suncook NH 03275. RF961

SCANNER FREQS: Listen to baby monitors WOW! Cellular phones, portable phones, all only $9.95-SASE. SCANFUN, 16943 Jenikay, Houston TX 77084. RF962

VIDEOCIPHER /SATELLITE/ SCANNER/ CABLE/ AMATEUR/ CELLULAR. Repair Manuals, Modification Books & Software. Catalog-$3.00. TELECODE P.O. Box 6426-RF, Yuma AZ 85366-6426. RF963

JOIN FAIRS-THE FOUNDATION FOR AMATEUR INTERNATIONAL RADIO SERVICE. Hams who are dedicated to building international friendship by providing technical assistance, training, exchange visits, and equiment donations on a global basis. Free information. Toll-free 1-800-FB-KK4WW or 703-763-3311. P.O. Box 341, Floyd VA 24091. RF995

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FOR SALE: Commodore SX-64 computer. (C-64 portable with built in drive and monitor) perfect for packet. $325. Supra 20 meg hard drive for Amiga 500 with 2 meg memory. $350. K9AEG, 715-454-6793. RF997

COLLEGE $$$$$$ for ALMOST ANYONE! CALL for your **FREE** copy of "10 Ways To Stretch Your Scholarship Chances". 1-800-524-4916 (73 de NX7T). RF998

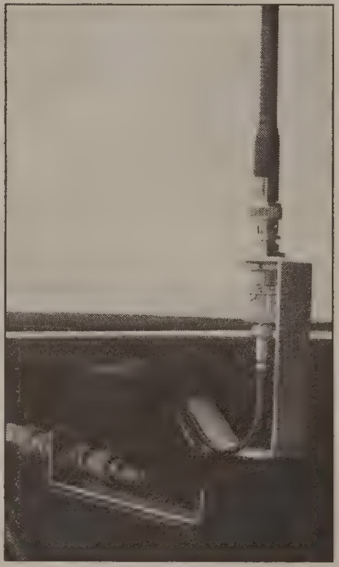
AMATEUR RADIO REPAIR!! All makes-maximum labor per unit, $80.00. TELO (Dan), 1302 S. Uplands Dr., Camano Island WA 98292. (206) 387-3558. RF999

new products

W & W ASSOCIATES

W & W Associates has introduced replacement batteries for Standard's C228/C528. The complete battery packs are available at 12V @ 600 mAh and 7.2V @ 1100 mAh. These packs are interchangeable with the Heathkit HW-24T radio.

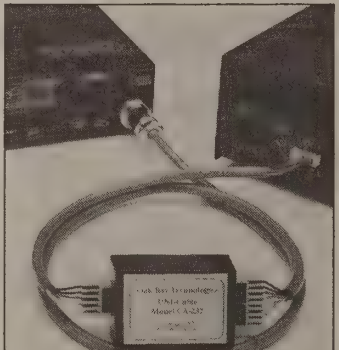
For prices and more information, contact *W & W Associates, 29-11 Parsons Blvd., Flushing NY 11354; (718) 961-2103, (800) 221-0732, Fax: (718) 461-1978.* Or circle Reader Service No. 201.



TRIONICS

Trionics has introduced a new Window Antenna Mount, Model BWM-1, designed to get the user's antenna out of the car and above most rooflines. This rugged metal mount fits onto the car or truck window for temporary mounting of hand-held antennas like the rubber duck. The almost 4" height to the top of the connector is an aid in extending the range of the hand-held's signal to local repeaters. The mount features a dual BNC-type connector that allows users to use their own coax or the optional Model BC 6-174, a 50-ohm, 6-foot, BNC-BNC, small coax cable.

The BWM-1 mount is priced at $13.95 and the BC 6-174 cable is $10.95. Both the mount and cable are available as a combined package for $23. CA residents add sales tax. To order, contact *Trionics, P.O. Box 1434, Rancho Cordova CA 95741-1434; (916) 366-7408.* Or circle Reader Service No. 202.

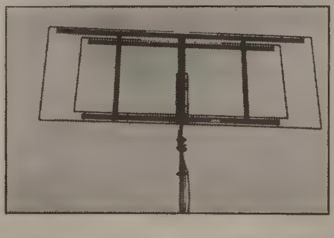


OAK BAY TECHNOLOGIES

Oak Bay Technologies Model CA-232U, Uni-Cable™, provides the first universal solution to packet TNC-to-transceiver interfacing. The Uni-Cable will interface all TNCs to any transceiver which uses an 8-pin microphone connector, a first in eliminating the tedious task of custom building interface cables. It comes complete with easy-to-follow instructions, a presoldered microphone connector and cable that dramatically eases the interfacing to the transceiver and a special interface unit.

Users can easily program and reprogram the cable interface to match any 8-pin transceiver, making changing transceivers a snap as only the programming changes, not the cable. The CA-232U requires no soldering. Future options will include a universal hand-held interface for portable operation.

For prices and more information, contact your favorite amateur radio dealer or *Oak Bay Technologies, P.O. Box 911, Woodinville WA 98072; (206) 883-6563* Or circle Reader Service No. 203.



D & D CLIFFDWELLER ANTENNAS

The compact, sturdy, attractive Endfire™ Open Loop antenna from D & D Cliffdweller™ Antennas works well using low power and at a low installation height. It has four radiating lobes. The two larger ones come off the broadside of the antenna in a pattern similar to a dipole but with about 6 dB of gain; the two smaller ones come off the vertical component, also have gain, and have a low angle of radiation. These lobes offer great DX because you get a longer skip. In addition, a hairpin match tunes out the capacitance to match the impedance of your line so that all of the signal gets out. The initial set-up cost is low: You can use a tripod or other roof mount since height isn't required, and fewer feet of coaxial cable are needed (this also means less line loss).

The Endfire is available in either an economy frame (Western cedar) or a deluxe extruded fiberglas model, and can be custom-built whether you require a single-band or multiband antenna. For prices and more information, contact *D & D Cliffdweller Antennas, 160-C Green Street, Somersworth NH 03878; (603) 692-4742.* Or circle Reader Service No. 204.

Uncle Wayne's Bookshelf

BOOKS FOR BEGINNERS

20N018 **Technician Class License Manual: New No-Code** ***by Gordon West*** This book will cover everything you need to become a Technician Class Ham. Every exact question and answer on the examinations is found in this one book covering element 2 and element 3A question pools. Gordon West tells you the right answer and then explains in detail why the answer is correct. Fully illustrated text, frequency chart showing privileges, list of examiners and an FCC Form 610 application. **$9.95**

20N092 **The Wonderful World of Ham Radio** ***by Richard Skolnik, KB4LCS*** This book addresses the plea that something simple, clear, and fun be written to introduce young people to amateur radio. Pick up one for the new ham in your life. **$7.95**

20N099 **Digital Electronics Projects for Beginners** ***by Owen Bishop*** contains 12 digital electronics projects suitable for the beginner to build with the minimum of equipment. 128 pp., 56 line drawings **$12.50**

20N100 **Electronics Build and Learn (2nd edition)** ***by RA Penfold*** combines theory and practice so that you can `learn by doing.' Full construction details of a circuit demonstrator unit that is used in subsequent chapters to introduce common electronic components. Describes how these components are built up into useful circuits, oscillators, multivibrators, bistables, and logic circuits. 128 pp., 18 photos, 72 line drawings. **$12.50**

AR2073 **Novice Antenna Notebook** A beginner's guide to easy and effective antennas and tuners you can build. **$8.00** An ARRL Publication.

AR2871 **W1FB's Help for New Hams** ***by Doug DeMaw W1FB*** Complete for the newcomer. Put together a station and get on the air. **$10.00** An ARRL Publication.

AR2286 **First Steps in Radio** ***by Doug DeMaw W1FB*** Series of *QST* articles. See components assembled into practical circuits and how the circuits make up your radio gear. **$5.00** An ARRL Publication.

AR3291 **Now You're Talking!: Discover the World of Ham Radio** Successor to the immensely popular *Tune in the World with Ham Radio*. Covers everything you need to know to earn your first Amateur Radio license. More than a study guide, this book will help you select equipment for your ham radio station and explain how to set it up—- everything you'll need to know to get on the air! An ARRL Publication. **$19.00**

AR3292 **Your Introduction to Morse Code: Practice Cassettes** companion code course to *Now You're Talking!*, this kit includes two 90 minute cassette tapes. Prepares you for the 5 WPM Morse code exam to earn your Novice license or add high-frequency worldwide communications privileges to your code-free Technician license. **$10.00**

SHORTWAVE

06S57 **1992 Passport to World Band Radio** ***by International Broadcasting Services, Ltd.*** You can have the world at your fingertips. You'll get the latest station and time grids, the 1992 Buyer's Guide and more. 384 pages. **$16.50**

07R25 **The RTTY Listener** ***by Fred Osterman*** New and expanded version. This specialized book compiles issues 1 through 25 of the *RTTY Listener Newsletter*. It contains up-to-date, hard-to-find information on advanced RTTY and FAX monitoring techniques and frequencies. 224 pages. **$19.95**

09S42 **The Scanner Listener's Handbook** ***by Edward Soomre N2BFF*** Get the most out of your scanner radio. Covers getting started, scanners and receivers, antennas, coaxial cable, accessories, computer controlled monitoring, more. **$14.95**

03S208 **Radioteletype Press Broadcasts** ***by Michael Schaay*** Covers schedules of Press Services by time, frequency, and country broadcasting in English, French, German, Spanish, and Portuguese. Detailed Press Agency Portraits. 120pp. **$12.95**

03K205 **Guide to Radioteletype (RTTY) Stations** ***by J. Klingenfuss*** Updated book covers all RTTY stations from 3MHz-30MHz. Press, Military, Commercial, Meteo, PTTs, embassies, and more. 105 pp. **$12.95**

11RF13 **The "Top Secret" Registry of US Government Radio Frequencies (7th Ed.)** ***by Tom Kneitel K2AES*** This scanner directory has become the standard reference source for frequency and other important information relating to the communications of federal agencies. 25 to 470 MHz. **$19.95**

11F52 **Ferrell's Confidential Frequency List** ***compiled by A.G. Halligey*** All frequencies from 4MHz—28MHz covering ship, embassy, areo, Volmet, Interpol, numbers, Air Force One/Two, more 376 pp. **$19.50**

11EE06 **Guide to Embassy Espionage Communications** ***by Tom Kneitel K2AES*** Candid and probing examination of worldwide embassy and (alleged) espionage communication systems and networks. Extensive nation-by-nation directory of embassy stations is included. **$10.95**

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IBM06, COM06 **IBM/Commodore Tech No Code—Lanze Code Program contains all the authorized FCC questions and answers used in testing formulas, schematic symbols, diagrams, and sample test for passing the new Technician No Code license. $24.95**

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05A95 Easy-up Antennas for Radio Listeners and Hams ***by Edward M. Noll*** Like to learn how to construct low-cost, easy-to-erect antennas? Easy-up Antennas will help you. **$16.50**

01A70 **Practical Antenna Handbook** ***by Joseph J. Carr*** Design, build, modify, and install your own antennas. Carr, a 20-year veteran of technical writing, has a unique ability to present complex technical concepts in an easy-to-understand way. 416 pp. **$21.50**

UHF/VHF/PACKET

10A347 **All About VHF Amateur Radio** ***by William Orr W6SAI*** DX propagation, VHF yagi and quad beams, repeaters and how they work, OSCAR satellites and how to use them. **$11.95**

03R02 **RTTY Today** ***by Dave Ingram K4TWJ*** Only up-to-date RTTY book in existence. Covers all facets of RTTY. Most comprehensive RTTY guide ever published. Fully illustrated. 112 pages. **$8.50**

01P22 **The Packet Radio Handbook** ***by Jonathan L. Mayo KR3T*** ``...an excellent piece of work. Well worth reading for both the experienced and the new packeteer...the definitive guide to amateur packet operation."—-Gwyn Reedy W1BEL **Only $15.00**

20N019 **U.S. Repeater Mapbook** ***by William Smith,N6MQS*** The guide for traveling radio amateurs gives you repeater frequencies, and locations on easy to read state map. Includes all 50 states and 28–1200MHz. **$9.95**

ARRL BOOKS

AR1991 **ARRL 1992 Handbook (68th ed.)** 39 chapters, featuring 2,100 tables, figures and charts. The most comprehensive, well organized and affordable source of amateur radio reference material. 1232 pages. **$25.00**

AR1086 **ARRL Operating Manual** Packed with information on how to make the best use of your station, including: Interfacing home computers, OSCAR, VHF-UHF, contesting. **$17.00**

AR0194 **Antenna Compendium Vol. 1** Materials on verticals, quads, loops, yagis, reduced size antennas, baluns, Smith Charts, antenna polarization, and other interesting subjects. **$10.00**

AR2545 **Antenna Compendium Vol. 2** 42 papers covering verticals, yagis, quads, multiband and broadband systems, antenna selection, and much more. **$12.00**

AR2626 **Companion Software for Antenna Compendium Vol. 2** 5 1/4" MS-DOS floppy. **$10.00**

AR0488 **W1FB's Antenna Notebook** ***by Doug DeMaw W1FB*** Get the best performance out of unobtrusive wire antennas and verticals. Build tuners and SWR bridges. **$8.00**

AR0348 **QRP Notebook** ***by Doug DeMaw W1FB*** Presents construction projects for the QRP operator, from a simple 1 watt crystal-controlled transmitter to more complex transceiver designs. **$9.50**

AR4141 **W1FB's Design Notebook** ***by Doug DeMaw W1FB*** This plain language book is filled with simple practical projects that can be built using readily-available components and common hand tools. **$10.00**

AR1033 **The DXCC Companion** ***by Jim Kearman KR1S*** spells out in simple, straightforward terms what you need to be a successful DXer. **$6.00**

ARRL **License Manuals** all the theory you need to pass your test. Complete FCC question pools with answers.

AR2375	**Technician Class**	**$6.00**
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AR2030 Your **Gateway to Packet Radio (2nd ed.)** Tells everything you need to know about this popular new mode; how to get started, equipment you need, and more. **$12.00**

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20N101 **Everyday Electronics Data Book** ***by Mike Tooley BA.*** Information is presented in the form of a basic electronic recipe book with numerous examples showing how theory can be put into practice using a range of commonly available `industry standard' components and devices. 256 pp. 134 line drawings. **$18.00**

REFERENCE

02C30 **The Commodore Ham's Companion** ***by Jim Grubbs K9EI.*** 160 pages of useful information on selecting a Commodore computer for the ham shack, where to find specialized programs, the Commodore-packet connection, and more! **$9.50**

10F091 **1992 International Callbook** The new 1992 International Callbook lists 500,000 licensed radio amateurs in the countries outside North America. It covers South America, Europe, Africa, Asia, and the Pacific area (exclusive of Hawaii and the U.S. possessions). **$29.95**

10D091 **1992 North American Callbook** The 1992 North American Callbook lists the calls, names, and address information for over 500,000 licensed radio amateurs in all countries of North America, from Panama to Canada including Greenland, Bermuda, and the Caribbean Islands, plus Hawaii and U.S. possessions. **$29.95**

05H24 **Radio Handbook, 23rd Ed.** ***by William I. Orr W6SAI*** 840 pages of everything you wanted to know about radio communication. In-depth study of AC/DC fundamentals, SSB, antennas, amplifiers, power supplies, and more. **$29.50 hard cover only.**

01D45 **The Illustrated Dictionary of Electronics, 5th Ed.** ***by Rufus P. Turner and Stan Gibilisco*** Featuring more than 27,000 entries, an exhaustive list of abbreviations, and appendices packed with schematic symbols and conversion tables, this is by far the most comprehensive dictionary of practical electronics and computer terms available. 720 pages **$26.95**

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IBM97 **Amateur Radio Part 97 Rules** (includes updates, revised Commission's Rules, September 30, 1989) 5 1/4" disk IBM compatible only. **$9.95**

20N096 **How To Read Schematics (4th edition)** ***by Donald E. Herrington*** Written for the beginner in electronics, but it also contains information valuable to the hobbyist and engineering technician. This book is your key to unlocking the mysteries of schematics, beginning with a general discussion of electronic diagrams. **$14.95**

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20N020 **Secrets of RF Circuit Design** ***by Joseph J. Cam*** Written in clear non-technical language, covers everything from antennas to transistors. You will learn the basics of receiver operation, the po\roper use and repair of components in RF circuits, the principles of radio signal propagation from low frequencies to microwave, and much more! **$19.50**

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20N108 **The Easy Wire Antenna Handbook** by Dave Ingram K4TWJ. Get out your roll of wire and your wire cutters, you are ready to go with this new practical and easy to understand book. Gives you all of the needed dimensions for a full range of easy to build and erect "sky wires". Covers all of the many types of wire antennas along with a lot of his antenna secrets, and "How -to-do" helps. **$9.50**

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09P33	The Pirate Radio Directory (1990 Edition) By George Zeller	~~$7.95~~	$6.95
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RF0692

Continued from page 25.

5 Shoo Fly Cir., Givhans SC 29472; (803) 821-8100 recorder, or *(803) 871-7741.*

SPECIAL EVENT STATIONS

JUN 6-7

KEENE, NH Station KD1GJ will operate at the Monadnock Region Hot Air Balloon Festival, from 1400Z-2300Z each day. Frequencies: Lower portion of General phone bands on 80, 40 and 20 meters; Novice subband on 10 meters. For QSL, send QSL with SASE to ***KD1GJ, 52 Manchester St., Keene NH 03431.***

PHILADELPHIA, PA The USS Olympia RAC will sponsor Station WA3BAT aboard the USS Olympia, in conjunction with the US Naval Academy (W3ADO, USS Yorktown (W4USN), USS Little Rock (W2PE), USS Pompanito (WA6BXV), and the USS Drum/Alabama (K4RQQ), from 1400-2300 UTC, to commemorate the birthday of John Paul Jones, father of the American Navy. Frequencies: Phone-3.895, 7.245, 14.245, 21.365, 28.365 (all +/- 5 kHz). For a certificate, send QSL and a 9 x 12 SASE to ***Olympia RAC, PO Box 928, Philadelphia PA 19105.***

JUN 13-14

WARRENTON, VA The Fauquier ARA will operate Station K4LLQ at the US Army Communications-Electronics Command, Vint Hill Farms Station, Warrenton VA, during the Golden Anniversary celebration of this historic citadel of electronic warfare. "The Farm" was originally created as "Monitoring Station No. 1" during WWII to intercept radio transmissions. K4LLQ will operate 1300Z-2200Z. Frequencies: SSB-7232, 14232, 21322, 28432 kHz. CW contacts on request. Frequencies may move, depending on band conditions. QSL, SASE, or multicolor certificate (9 x 12 SASE and $3) to ***Fauquier ARA, 500 Hunton St., Warrenton VA 22186.***

CLINTON, IA The Clinton ARC will operate W0CS to commemorate the 1st anniversary of Riverboat gambling out of the port of Clinton IA. The station will be aboard the Mississippi Belle II floating casino. Operation will be from 0900-2100 CDT both days, in the lower 50 kHz of the General phone sub bands; on 40, 20, and 15 in the Novice segment on 10 meters. Also, 144.210+/- phone for EN41/EN42. QSL with #10 SASE to ***Darryl Petersen KD0PY, 1344 400th Ave., Bryant IA 52727.***

JUN 14

FT HAMILTON-BROOKLYN, NY
The Kings County Rptr. Assn. will operate Station WA2ZWP from 1200Z-2400Z, at the base of the Varrazano Bridge, to celebrate the 167th anniversary of Fort Hamilton Army Post. Operations will be in the General and Novice phone bands around 28.343, 21.343, 14.343, 7.243. For certificate, send QSL and SASE to ***Charles Quartana N2JZA, 2175 East 8th St., Brooklyn NY 11223.***

JUN 20-21

JUNCTION, TX Pat Rose W5OZI will sponsor 1992 SMIRK Party Contest #17, from 0000 UTC June 20-2400 UTC June 21. To obtain a copy of the official log sheet, send SASE to ***Pat Rose W5OZI, PO Box 393, Junction TX 76849 USA.*** Contest entries must be postmarked no later than 6 July 1992 and sent to the W5OZI address.

ALTOONA, PA The Horseshoe ARC will operate Station W3QZF from 1300Z June 20-2100Z June 21, to celebrate the 1992 US Cycling Federation Olympic Road Trials and Nat'l Championships that will be held in Altoona. Frequencies: Lower portion of the General phone privileges on the 40-15 meter bands; and the lower portion of the 10m Novice phone sub band. QSL with SASE to ***HARC, PO Box 225, Hollidaysburg PA 16648.***

JUN 27-28

NORFOLK, VA The Tidewater ARC will operate Station W4NV 1600Z June 27-1800Z June 28, to commemorate the establishment of the US Army's Fort Norfolk as a historic landmark. Operation will coincide with Field Day and will be in allbands 80-10 meters, CW and phone, plus AO-13. For QSL, send QSL and SASE to ***Tidewater ARC W4NV, 1234 Little Bay Ave., Norfolk VA 23503.***

JUN 29-JUL 12

NIAGARA-ON-THE-LAKE, ONT., CANADA The Niagara Peninsula ARC, Inc., will commemorate the Bicentennial of John Graves Simcoe, First Lieutenant Governor of Upper Canada, Niagara-on-the-Lake, by operating Station XJ3S on 80 thru 10 meters SSB, CW, and RTTY. For a special QSL card, send a QSL, SASE (USA funds and postage OK) to ***VE3VM, Niagara Peninsula ARC, PO Box 692, St. Catharines, Ont., L2R 6Y3, Canada.***

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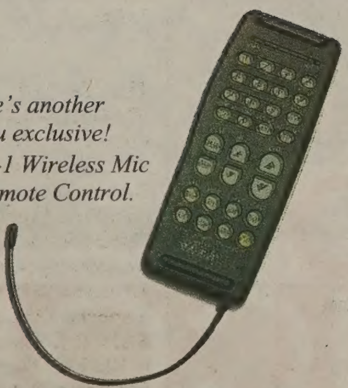

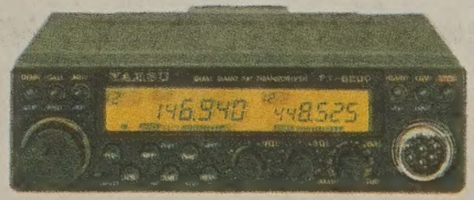

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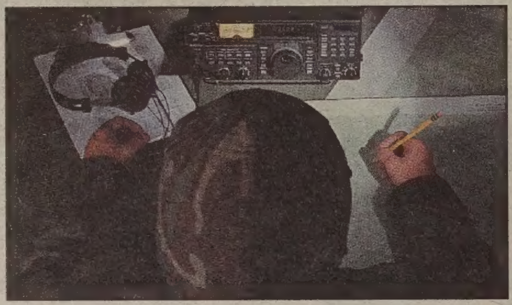

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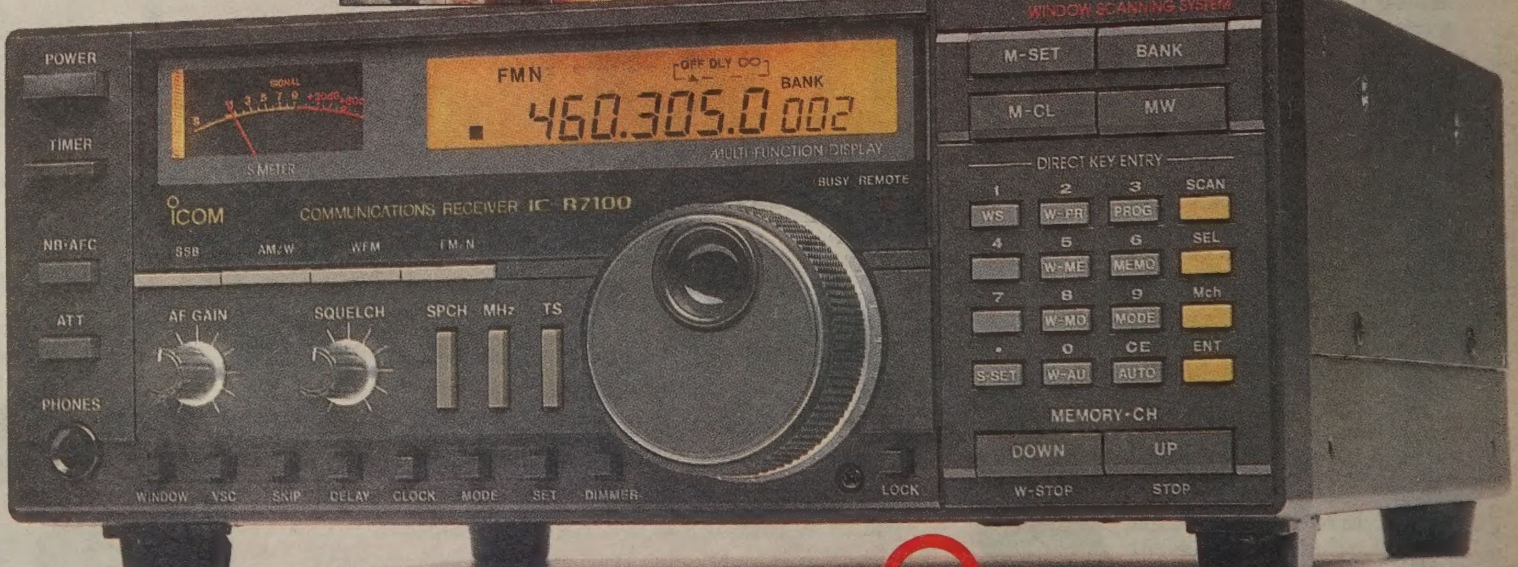

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